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TELEPHONE ENGINEER

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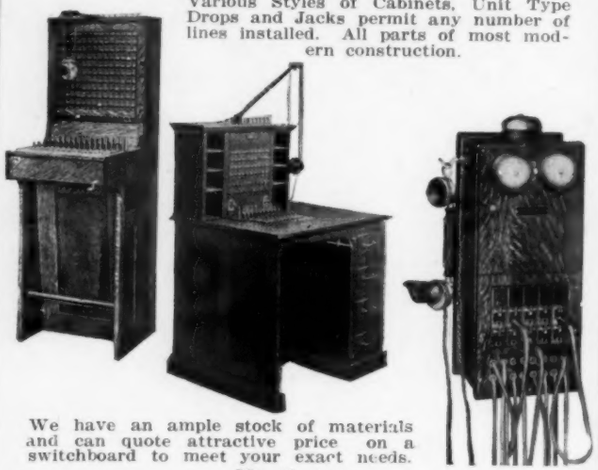

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TELEPHONE ENGINEER

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When the Well Runs Dry

DOWN in one of Illinois' mining towns the telephone operators went out on strike some months ago. There is no particular novelty in that situation, and we do not now recall the alleged grievance, or particularly care what it was. The strike was settled the other day, satisfactorily, presumably, to all parties. The significant thing about the event is the catalog of things that happened while the community was without telephone service.

Without any desire to gloat over the extraordinary misfortunes of that stricken settlement, we wish every telephone subscriber, of the thousands who make indignant outcry because they are asked to pay another twenty-five or fifty cents a month, could think of that Illinois situation in terms of possible application to their own condition. Those who never miss the water till the well runs dry generally still can get a pailful from a neighbor's pump; but when the community telephone goes out there is no substitute. It is all very well to talk about the days when we got along without them. Listen to the catastrophes that followed this particular reversion to pre-telephone days:

Five deaths, directly ascribed to the utter impossibility of calling doctors, druggists or nurses in time to be be of any service.

One quarter-million-dollar fire in a mine, which was too far advanced to be stopped by the time it was possible to round up assistance by the old-fashioned methods.

Recognition of the telephone as the most effective insurance against sudden trouble that can be installed in any house, rich or poor, is so commonplace in the telephone man's mind that it is trite. And so he fails to realize that the general public has not yet accepted the convenient instrument as a necessity. We still hear subscribers talking about taking out their telephones because the operating company has the effrontery to ask for a living rate. Comfortable and secure in their accustomed possession of the instrument, it has become so unconscious an adjunct to their daily lives that they think they can get along without it. They would scoff at the idea that disaster and death might hang on that very five or ten cents a week that may actually spell life or death to the company. Yet here is the demonstration.

All we need for actual existence is food, clothing, shelter and fuel. As soon as we progress beyond that primitive state, the telephone is one of the first provisions to bind us to a broader life; and without it, even those first four necessities are not so readily obtained.

The Day of Big Expenditure

ALTHOUGH the condition is already well known to our readers, we take a peculiar pleasure in printing on various pages, and in commenting upon here, the significance of the great bulk of news dispatches that come into our office these days. For their favorite subject is the spending of money; and the talk is generally of millions. Rare is the state whose telephone improvements for next year are not calculated into seven figures at least. Real estate is being acquired. Buildings are being planned, or are already in process of construction. New switchboards are being installed. Common battery is being substituted for magneto. Full metallic is replacing grounded lines. Pole lines are changing to cable. Overhead wires are going underground. One month's reading of all the news from all the states would convince the most cynical of old school telephone grumblers—the kind who have been saying for years that the telephone business was dead—that a veritable whirlwind of activity has sprung up.

And so it has. It is a long, long time since there was so much doing. The good old days of fevered construction, and shops full of rush jobs, have come back; or rather, they are surpassed. For today's business is not the business of the speculative promoter. Operating companies now are building for service. They are ready to pay for what they want, and they want the best and most modern; nothing is too good.

Perhaps the best part of the situation is that there is nothing abnormal about it. It is the natural sequel to a period of enforced desuetude and doubt. However strange the adventures through which fate has led the most ubiquitous of all utilities, however thickly minor troubles still may cluster, there is little seriously the matter with an industry that is preparing to spend in improvement the millions that the records show ready for use in this industry.

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THE SPIRIT OF SERVICE.

In the telephone operating field the Spirit of Service is paramount. Artists have conceived it in many poses. One we recall pictured a lineman, on snowshoes, battling a western blizzard to make sure that the all-important wires kept to their moorings. Here, in real life, is the other extreme; and no artist yet has conceived a better example. This is the big New York oil fire that destroyed so many tanks last month. The great tank in the foreground is already venting ominous puffs of smoke, and the fire fighters are playing deluges of water upon it to stave off the threatened explosion. The house at the right has become a derelict. Yet in the midst of the confusion and terror, the lineman mends his wires, that the telephone may not cease its function.

Photo from Underwood & Underwood.

PENNSYLVANIA RAILROAD TRAINING GIRL DISPATCHERS.

Women are after another man's job. They have made good at every position that has been opened to them so far, so the Pennsylvania Railroad is giving them the opportunity to learn to be telephone train dispatchers. Of course they would not step right from the school to the job of guiding trains through the intricacies of terminals and yards. They will first have to serve apprenticeships as operators along the line of the Pennsylvania system. This photo shows one of the girls learning how trains are moved by telephone over the system in the school of telegraphy at the Broad street station in Philadelphia.

(Fig 1) SIMPLE DIAGRAM SHOWING GENERAL ARRANGEMENT.

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Bell's "Photophone" Made Practical

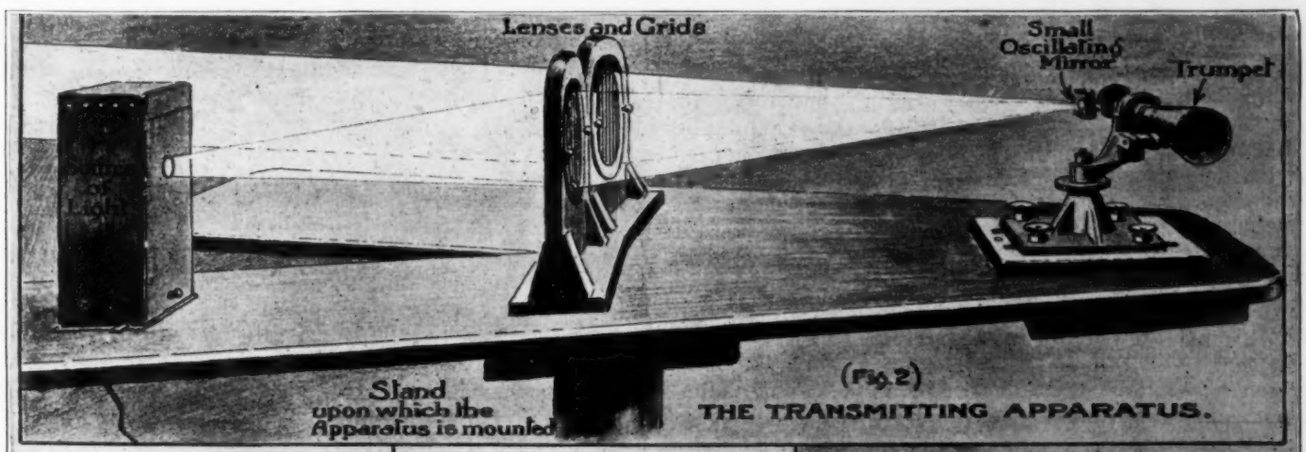
Beam of Light Replaces Telephone Wire for British War Signals

AWAY back in 1889, only a few years after the telephone itself was invented, Prof. Alexander Graham Bell took out patents on a method of telephoning over a beam of light. This "photophone" really worked, in a limited way, and became quite a scientific curiosity. Its description is still to be found in various works on physics and elementary electricity; but the device itself never developed further than the experimental stage, and in nearly thirty years made no progress toward practical application.

But now we learn that the photophone has been made practical, and indeed has been in everyday use during the last months of the war, adding to the British army's signal facilities. The ingenious invention that made this possible goes to the credit of Dr. D. A. O. Rankine, a young English scientist. Dr. Rankine is a fellow of University College, London, and assistant professor in the department of physics.

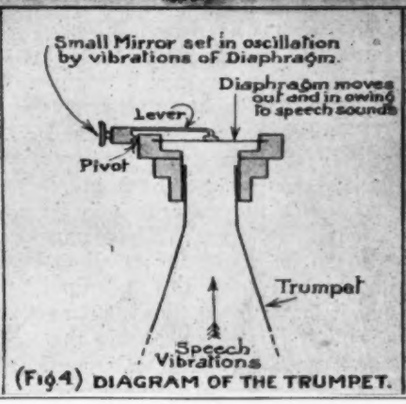
The problem of telephoning by light was referred by the British admiralty to the scientists of University College. Dr. Rankine solved it. Picture a sort of gun mounting, the platform of which can be rotated or elevated at any angle. Instead of a gun there is a wooden platform shaped like a V. At the end of one of the arms in a small enclosed electric-arc light. In the center of the arm is a circular grid. On the other arm in a corresponding position is a second grid. Where the arms join is a peculiar arrangement, the main features of which are a trumpet, a phonograph sound box, and a small concave mirrior. At the side there is a gun sight. This is the sending end. The receiving end is simpler. A small mirror or lens is in front of a selenium cell which, in turn, is connected with a battery and a telephone receiver.

This is how it works. The light, whether sunlight or searchlight, is reflected through a lens and then through a grid onto the concave mirror. When anyone speaks into the trumpet the sounds are collected by



(Fig 2) THE TRANSMITTING APPARATUS.

(Fig 3) ANOTHER VIEW OF THE TRUMPET.



(Fig 4) DIAGRAM OF THE TRUMPET.

(Fig 5) SHOWING TRANSMITTER FOR USE WITH SUN AS SOURCE OF LIGHT.

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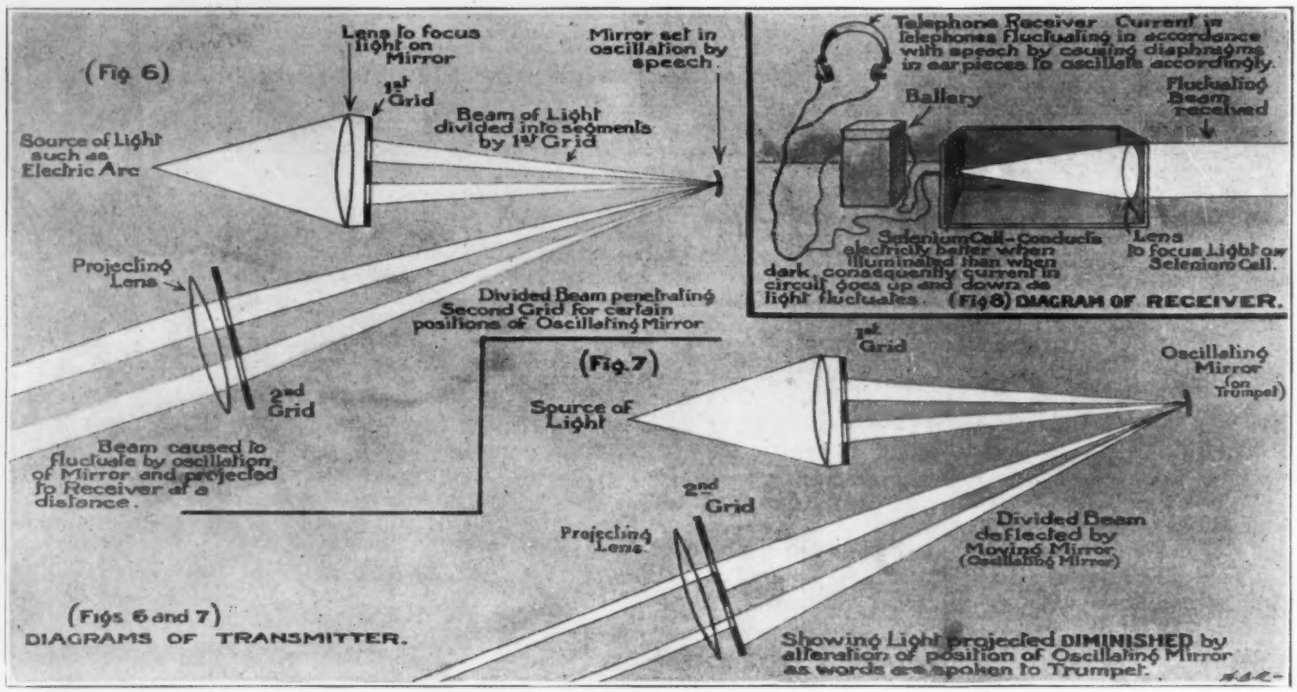
Diagrams That Explain Themselves, Showing the Arrangement and Action of Rankine's Improvement on the Photophone.


(Fig 6)
Lens to focus light on Mirror
Mirror set in oscillation by speech
1st Grid
Beam of Light divided into segments by 1st Grid
Source of Light such as Electric Arc
Projecting Lens
2nd Grid
Divided Beam penetrating Second Grid for certain positions of Oscillating Mirror
Beam caused to fluctuate by oscillation of Mirror and projected to Receiver at a distance.
(Fig.7)
Source of Light
1st Grid
Oscillating Mirror (on Trumpet)
2nd Grid
Projecting Lens
Divided Beam deflected by Moving Mirror (Oscillating Mirror)
Showing Light projected DIMINISHED by alteration of position of Oscillating Mirror as words are spoken to Trumpet.
(Figs 6 and 7)
DIAGRAMS OF TRANSMITTER.
Telephone Receiver. Current in telephones fluctuating in accordance with speech by causing diaphragms in ear pieces to oscillate accordingly.
Battery
Fluctuating Beam received
Selenium Cell - Conducts electricity better when illuminated than when dark, consequently current in circuit goes up and down as light fluctuates.
Lens to focus Light on Selenium Cell.
(Fig 8) DIAGRAM OF RECEIVER.

Copyright, Illustrated London News. *Further Diagrams Showing Action of Light.*

a phonograph sound box. The sound-box needle vibrates in accordance with the sounds. As the mirror is fixed to the needle, the mirror vibrates too. The image of the first grid is reflected from the mirror onto the second grid, which, being milled with the first, is an exact reproduction of it, but inverted. So when the mirror vibrates, it sends the gridded light against the second grid, and according to the sounds made in the proportionate amount of light that goes through the grid. So there is a shutter-light effect just like shutter signaling.

This light is trained, by means of the gun sights, on the mirror of the receiving instrument. The mirror concentrates the light on the selenium cell. Selenium is sensitive to light. Its power of conducting electricity varies with the intensity of the light thrown on it. The grid, acting as a shutter, varies the light intensity in correspondence with the movements of the mirror attached to the sound box. The electric battery and the telephone receiver do the rest.

In this way speech has been sent over a beam of light a distance of a mile and a half. The tests, owing to war conditions, have been limited. As far as the inventor can tell there is nothing to limit the distance over which messages can be sent except the limit of mutual visibility. At sea it should be possible to send them from horizon to horizon. On land the distance should be as far as light can travel without interruption. In heliography 70 miles is the longest distance attained. This was in the Wagiri expedition of 1881, with a five-inch mirror.

But there is no present prospect of the sunphone reaching out so far as that. It is certain to be effective for eight miles. How much farther it may be practical to use it no one as yet knows. The original experiments were carried out under war conditions. It was necessary to keep them secret. Long distance experiments were outside the scope of secrecy. So the instrument, while brought to perfect accuracy for short ranges, has yet to be tested for long ones.

This is what the inventor says about it: "It has proved to be a practical and reliable means of transmitting speech by light, and ranges up to 1½ miles have been achieved, in spite of the fact that, owing to war conditions, it has not yet been possible to construct the apparatus in its most convenient form. There appears also to be room for considerable improvement in the selenium cells which have been used as receivers, and it is quite probable that the range can be increased to several miles."

The great advantage of the sunphone is that messages can be tapped only by getting in the way of the beam of light. This would be obvious to those using the instrument at once. As it could be so easily detected, it would not be worth while attempting it. Wireless telephone messages are easily tapped. It is only a matter of finding the right key. You can also join wireless. But you cannot join sunlight. It is easy to intercept a beam of light, of course. Yet it would be risky. To do it would mean getting in between, in the direct line of light. It would mean instant discovery—and trouble to follow. That is the only way the sunphone can be tapped. No one can overhear conversations over it. It is quite safe and quite secret. Safer and more secret than wireless, though not of course comparable to it in range. The sunphone is superior to the heliograph as it needs no code.

Two main methods of solving this problem of speech transmission by light have been tried by previous experimenters. One was to cause variations corresponding with the vibrations of speech in the source of the light itself. The other was to produce the fluctuations indirectly by causing the speech to interrupt the light after it had left its source. The second is the one used by Dr. Rankine. For this reason he is able to employ sunlight as well as artificial light. If he had kept to the

other method obviously sunlight could not have been used. The average frequency of speech sounds is about 500 per second. That means that the brightness of the beam of light must alternate between maximum and minimum every one-five-hundredth of a second.

"In a patent specification of 1889, A. Graham Bell describes two devices," writes Dr. Rankine. "In the first the proposal is to allow the beam of light to pass in succession through two grids consisting of equal parallel strips alternately opaque and transparent. One of these is fixed in position and the other is moved bodily in a direction perpendicular to the strips by the operation of a diaphragm to which it is rigidly attached, and on which speech sounds fall. The movements of the diaphragm may be expected therefore to control the obstruction to the beam of light in such a way that the intensity of the emergent beam varies in accordance with the speech sounds. The practical objection to this device is that ordinarily the movements of the diaphragm are so small that it would be most difficult, if not impossible, to make grids at once so light, so rigid, and so fine as to fulfill the necessary conditions. Prof. Bell did not, in fact, claim that this method had been actually used.

"His second device is much more sound from a practical point of view. It relies upon the fact that a vibrating diaphragm is continually altering its curvature; consequently if polished and interposed in a steady beam of light it will give rise to a reflected beam which is of variable divergence. Although the total amount of light reflected is actually unaltered, the fraction of it incident at a distance upon a receiver, not large enough to include the whole beam, will have a value controlled by the vibrations of the diaphragm. The objection in this case is that, of necessity, the diaphragm must be large in order to deal with a large quantity of light; for if it is placed at a point where the beam has been concentrated to a focus, the effect of its changes of curvature upon the divergence of the beam is negligible. Further, from an acoustical point of view, it would be necessary for the diaphragm to be thin and it would, therefore, not be suitable for adaptation as a mirror of good optical properties."

"In my apparatus," says Dr. Rankine, "the essential point is the substitution of the image of a grid for the grid itself. This substitution at once surmounts all the difficulties inherent in Bell's first proposal. It is no longer necessary to attempt to construct diminutive grids suitable for being mounted upon and operated by speech receiving diaphragms. Both grids are now fixed in position and may be of practically any size. It is the image of the first grid which is caused by the incident speech to move to and fro with respect to the second grid. The image of the first grid, in moving to and fro over the second grid, in effect opens and closes a shutter in the path of the beam."

A special reflector is set up for use with sunlight. It is a plain mirror nine inches in diameter. It projects the light through a water cell to remove most of the thermal radiation. Then it passes through a lens and the first grid, and focuses on the oscillating mirror on the sound box.

Telephone System for the Theater

An interesting telephone system has recently been installed at the Princess Theater, Crayford, England, by the Western Electric Company, Ltd. The system was originally produced by the company in America with a view to enabling people suffering from deafness to hear the service, and for want of a better name it has been termed the church telephone. In fact, this title is a misnomer, because the possible commercial applications of the system extend far beyond the parish church. Essentially the apparatus consists of three sensitive telephone transmitters mounted on a base and connected in parallel, from which a twin wire is taken to a receiver jack, and at a convenient point a battery of two cells is placed in series with one wire of the twin cable. To use the apparatus it is only necessary to insert the plug of the receiver into the jack and listen. On withdrawing the plug the battery is disconnected and audition ceases. Several receivers can be used off one transmitter system, but it is not advisable for more than six receivers to be in action at one and the same time.

The receivers are of the simple watch type, fitted with a telescopic handle for convenience in holding the instrument to the ear. The jack is of the single type and mounted in a neat, inconspicuous wooden case. The best results are obtained when the transmitter is fixed 3 or 4 feet in front of the speaker, but it is not essential for speaker to talk actually towards or directly at the transmitter Where it is not possible to fix the transmitter in front of the speaker, quite good results can be obtained with other positions by increasing the battery strength. The bottom of the transmitter base is padded with felt to reduce vibration, and where vibration is likely to be excessive this can be replaced by rubber. In the actual installation under notice the transmitter is mounted in the center of the orchestra rail, almost behind the conductor and the receiver is fixed in the manager's office at the entrance to the theater. Quite successful demonstrations were made and remarkably clear effects obtained when very subdued conversation was taking place on the stage. Further tests were made during an organ recital and again the sounds were quite clearly and truthfully reproduced without "shrieking" taking place on the high notes. There was also installed a loud-speaking receiver device which removed the necessity of placing the receiver to the ear. As installed the system allows the manager to know the position of the progress of the play without leaving his room or telephoning to the stage manager. By simply plugging in the jack and listening he can hear what is happening on the stage at any time. The system can also be used for other purposes; *e. g.*, by wiring the auditorium persons with defective hearing could be enabled to hear better, and receivers could be hired in the same way as opera glasses. In lecture halls, churches, etc., the system could be utilized to add to the comfort of the audience. The theater is also fitted with an elaborate system of Western Interphones.

Half Million Independent Telephones in Illinois

In Illinois, alone, there are 1,300 Independent telephone companies serving approximately 500,000 subscribers, and having $60,000,000 invested in the plants through which they serve the public.

There are about 30,000 investors of this money, of whom 80 per cent live in the same towns in which the companies render service, the stock usually being held by the home people and the bonds by the home bank.

These companies not only link up practically very farm with outside communication, but operate also in many of the larger cities of the state.

Systems of Handling and Recording Trouble

Read Before the Telephone Plant School at Purdue University, La Fayette, Ind.

BY V. N. GREGG*

WHAT is to be gained by a system of handling and recording trouble? Can the plant be maintained to a higher degree of efficiency with a resulant saving in depreciation and less complaints of trouble from subscribers? The answer is dependent on the interest shown in the data obtained from the system and on the application of this data to the securing of better maintenance.

The primary object of a trouble system is to restore service as promptly as possible. This may be a tool line, a subscriber, a trunk, an order wire, a position, or to any other apparatus. The routine to be followed in restoring service is dependent on local conditions, the amount of trouble, the men available in cases of extensive trouble, such as sleet storms, fire damages, etc., and the importance of the apparatus or lines in trouble, which is governed by the commercial value of the line or lines. As the toll lines are the source of the greatest revenue, it is obvious that they should receive the first consideration in the clearance of trouble. The subscribers' lines in the order of their importance come next, except in the case of multi-office districts, when trunks should probably be considered before the subscribers' lines.

It is customary in cases of extensive trouble to make such temporary repairs as will produce the best results, following with permanent repairs at a later period. This course is only pursued if the temporary repairs can be done in considerably less time than the permanent. For the ordinary trouble, temporary repairs should not be considered. It is the temporary work that in time produces the largest amount of trouble. Unsoldered hand joints, wires twisted around terminals, and not soldered, and similar work will require additional work in time.

The methods of handling and recording troubles covered by this paper will consider only such routine trouble as is ordinarily reported. As toll lines are the most important from a revenue standpoint, it is advisable that some routine be established to clear toll line trouble as promptly as possible. The night operator can be assigned the duty of testing all toll lines, the testing consisting of ringing and talking. Trouble encountered can be properly noted and the wire chief or troubleman is then in a position to test the trouble and take the proper steps for its clearance, before the busy hours and before engaging in the clearance of less important trouble. Many valuable hours of toll circuit time can be saved by instituting a good trouble routine for toll lines. The present high prices for material restrict the building of new lines and the congested condition of toll lines can be remedied, to a great extent, by prompt clearance of trouble.

The value of routine inspections and tests is not realized until they are placed in operation. Incipient troubles are discovered and cleared, causing less annoyance than if they were allowed to continue until they caused complaint. For routine tests on central office equipment, the night operators can usually be depended upon. The repairmen can do much good by inspections to determine if any other part of the subscribers' station, cable box or line, in addition to the part they are working on, is in good condition and will not require attention in the near future.

The system of recording exchange trouble varies with the size of the exchange. In the smaller "one-man" exchanges very often the trouble system consists of Mary telling Jim that "Mrs. Smith's telephone is out of order again." Jim states that he knows just where the trouble is and proceeds to repair it, and the record ends until the next "again" period. In this case the system used is probably just as valuable for the purpose of better maintenance as the majority of systems in use. The reason the systems do not give results is due to the fact that most of them simply cover the recording of trouble. The system in use should not, however, be condemned until it is determined that the application of the data secured will not tend to better maintenance.

While an elaborate system is not applicable to the smaller exchanges, a record of trouble experienced would prove valuable in showing repeat cases and in determining validity of claims for being out of service. If the complaint is reported to the chief operator and OK'd to her by the repairman, the subscriber's card record could, to advantage be kept by the chief operator. In a number of smaller exchanges the chief operator has been known to make tests from the central office, so as to enable the repairman better to perform his work.

In medium size, and some of the larger exchanges, the complaint is usually reported to the chief operator, or to some operator designated for that duty, who enters the report on some form of ticket and an entry is made, in a record maintained by her showing complaint-ticket serial number, telephone number, etc. The term "complaint ticket" is used in preference to "trouble ticket," as all complaints do not signify trouble. The complaint remains as such until the test shows or there is no trouble found.

The complaint ticket can be elaborate or simple as desired; the more elaborate it is, the less writing is required by those handling the ticket. A ticket showing a serial number, the time and date, the subscriber's name and the telephone number, with spaces for the complaint, the trouble found and the troubleman's O. K. and time OK'd will usually be sufficient for all purposes. As it is customary to employ some code to designate the complaint as B. D. R. for "Bells doin't ring" and C. G. C. for "Can't get Central," this code can, if desired, be printed on the form. The results of the test by testman, such as "open," "Grded," "XD," etc., could also be printed on the form, thus permitting the checking of the code covering the complaint and the test, and would probably be an advantage where a considerable volume of work is handled.

The ticket, after the necessary information is recorded by the chief operator, is forwarded to the testman for action. He usually tests the line reported to determine the nature of the trouble, assigning the trouble to the repairman covering the district in which the trouble is located. After the trouble has been cleared the repairman receives his

*Supervisor of equipment, Central Union Telephone Company, Indianapolis.

OK from the testman, advising the testman the nature of the trouble found. The testman then OK's the ticket, enters the report on the subscriber's card record, and forwards the OK'd ticket to the chief operator, for the clearance of her record. The ticket is then filed. It is considered an advantage for the testman immediately on receiving a complaint to secure the subscriber's record card and note whether a similar case of trouble has been reported within a recent period. If this is the case, he is in a position to intelligently handle the ticket and take steps to prevent another similar complaint being reported. The testman also has all other data such as, cable pair, type of instrument, and other information relative to the station which may be required. The record card is also then available for the immediate entry of the trouble when cleared.

Practices vary as to the routine employed by the repairman for taking a record of the trouble. Some companies furnish the repairman with printed slips for entering the complaint as it is given to him by the testman, the repairman in addition to his verbal report to the testman turning in his tickets, properly noted, at the completion of his day's work. Other companies allow the repairman to use his own judgment as to how to record the complaint, not requiring any other report but the verbal one to the testman. Some companies furnish the repairman with a printed form he is to use to report conditions he finds impossible or impracticable to correct and which require the attention of the line foreman or a complete re-wire of a station.

Some of the larger exchanges have in service what is called the "repair clerk system" for handling complaints pertaining to trouble. The repair clerk, who is usually an employe secured from the traffic department, is located at a desk adjacent to the wire chief's test desk. It has been considered the best policy to secure the repair clerk from the traffic department, as she will be more familiar with the method of handling complaints than a new employe. Located in the repair clerk's desk is a card for each subscriber, trunk and position of switchboard. Her desk is also equipped with trunks from the switchboard. All complaints, regarding trouble, during the hours the repair clerk is on duty, are connected to the repair clerk's desk. The complaint is entered directly on the subscriber's card and this card is then turned over to the testman for action. A blank card of a different color is inserted in the place of the card removed, this indicating if a second complaint is made that the original complaint has been received and is being acted on. After the trouble has been cleared, the testman makes the proper records on the card, showing trouble found and time cleared, returning the card to the repair clerk for filing. During the hours the repair clerk's desk is not covered the traffic department records the complaints reported on memorandum tickets, forwarding these tickets for entry on the card record. The repair clerk's system has the advantages of handling complaints more promptly, eliminating duplication of records, and relieving the traffic department of the recording of the majority of complaints. The single item of handling the complaints more promptly is the best argument for this system. The subscriber is undoubtedly left with a good impression, if he is advised by the testman, almost immediately upon making a complaint, that his line has been tested and steps are being taken to remedy the trouble. As under this system the card is the only record handled by the testman, he has a complete record of the subscriber's station and trouble previously experienced, and can then determine if trouble at that station is excessive.

The subscribers' and other record cards in use in connection with various trouble systems, are very similar in form. The information generally recorded for each station is the number, name, and address of the subscriber, the cable pair in use, a description of the instrument and appurtenances and location of the answering jack. Spaces are provided for entries of trouble and the back of the card is usually used for this purpose. Different colored cards are sometimes used to designate stations to which special attention should be given, such as doctors', hospitals', etc.

A card with different heading is used for recording trouble on trunks, operators' positions, order wires, and private branch exchanges.

It has been stated that the primary object of a trouble system is to restore service promptly. The trouble system to give good results should show by the number and nature of exchange troubles the condition of the exchange plant, and the efficiency of exchange maintenance. This is the secondary, but what may be considered the important object of a trouble system. A "trouble shooter" is all right in his place, but his place was in the olden times and not in the present day. The repairman with all the name signifies has taken the "trouble shooter's" place. The repairman, if he lives up to his name, will prove that a system designed to check his work will be of assistance to him and enable him to perform his duties with greater satisfaction. To show the condition of the exchange plant, the trouble will require classification and the percentage of troubles to subscribers' stations be determined at regular intervals to show the increase or decrease.

The trouble is usually divided into three classes, namely, Subscribers' Station, Outside Plant, and Central Office. Each of these divisions can be further subdivided: Subscribers' Station into Inside Wire, Protector and Instrument; Outside Plant into Cable, Terminals, Line, and Drop; Central Office into Frames, Subscribers' Lines, and Cord Circuits.

It is questionable whether divisions finer than these will be required, except for purposes of checking. For example; if subscribers' station instrument trouble is excessive, a further subdivision may show improper adjustment of ringers, improper tying of cords, or some similar cause of the large amount of trouble.

In the counting and classification of trouble, only those reported as requiring the attention of the repair forces should be considered. Such defects as are noticed on inspection, with a view of anticipating trouble should be recorded. Complaints of trouble due to improper manipulation of the apparatus, to a worn or unkept appearance, or to failure of apparatus to meet certain demands, but otherwise is working properly, should not be considered as trouble when classifying.

The trouble can be classified daily by the testman on a sheet provided for that purpose. The daily totals are then transferred to a monthly summary sheet, and the calculations for the monthly totals made from this sheet. The comparisons made from month to month indicate the condition of the maintenance of various parts of the plant, and any great variation should receive attention.

The handling of troublemen is a subject to itself. Much could be said, and examples mentioned of those who are not properly perform-

ing their work. This is not only true of those who do not know, but is also true of some who know the proper methods. A process of education must be constantly carried on which will enable the unskilled to become skilled. Those in a supervisory capacity must be alert to intelligently direct their forces, so as to secure the best results. Temporary work by troublemen must be eliminated and the careless workman must be cautioned to be careful. The results obtained, if the work is properly performed, will enable us to render more efficient and satisfactory telephone service.

McHenry Again President in Missouri

For the fourth time in succession Houck McHenry has been honored by the members of the Missouri Telephone Association by being elected as president of the organization.

Claud D. Long was also re-elected secretary of the association and a resolution thanking him for his excellent work during his connection with the organization was passed by a unanimous vote.

One of the results of the meeting held at Jefferson City September 24, was the filing of an intervening petition with the Public Service Commission in the matter of the Kansas City Telephone Co., in its application for a standard charge for installing and changing telephone apparatus. The telephone managers feel some fixed charge should be made in a ruling by the petition. Under government management a charge of $3.50 was made for a new telephone and $1.50 for a change or a new number being placed in the directory and opening a new account.

The meeting was called to order by President Houck McHenry who insured them of their welcome to the Capital City. Governor Gardner, before leaving for his tour of Southwest Missouri, addressed the convention in his usual pleasing manner. His auditors were more than pleased with his speech.

E. L. Chase spoke on the relation of labor and capital in an interesting way. Other speeches were of a technical nature of interest to telephone men along the lines of bettering service. Chairman W. G. Busby, of the Commission, made a talk.

Following the hearing the final session of the convention was held and the following officers were elected for the year:

Houck McHenry, president, Jefferson City; A. M. Benedict, first vice-president, Richards; S. D. Thompson, second vice-president, Cameron; H. H. Holman, third vice-president, Warrenton; T. C. Yeager, fourth vice-president, Canton; H. L. Harris, treasurer, Kansas City; G. W. Schweer, membership secretary, Clinton; Claud D. Long, secretary, Jefferson City. The executive officers are S. T. Neill, Clinton; M. L. Golloday, Holden; R. A. Guthrie, Macon; H. L. Harris, Kansas City; H. C. Todd, Maryville; C. W. Boutin, Cape Girardeau; J. A. Hudon, Columbia; W. H. Bassett, St. Louis, and G. V. Ross, St. Louis.

The following are resolutions adopted:

"*Be it Resolved*, by the Missouri Telephone Association, that it heartily endorses the proposed $60,000,000 road bond issue, to be submitted to the voters of the State of Missouri at the next general election.

"*Be it Resolved*, by the Missouri Telephone Association assembled in convention, September 24, 1919, that it is the opinion of this Association that public ownership of public utilities is inadvisable, an dthat at the present time any further legislation relative to the regulation of the telephone companies, is not desirable, as such companies should have time and opportunity to adjust their affairs and return to normal conditions.

"*Be it Resolved*, that this Association believes that all toll rates of telephone companies should be standardized and the Missouri Public Service Commission should be urged to lend its aid in securing such standardization as will harmonize with the practice in other states, and further, that free toll service be eliminated."

The convention was the best attended since the organization of the association some years ago. Attendance at the meeting showed representation of 212 telephone exchanges.

Airplane View of the Buildings and Grounds of the United States Bureau of Standards at Washington, D. C., Best Known to Telephone Men Through the Convention Addresses of Its Telephone Director, Dr. Frank A. Wolff.

Test Case for Minnesota Minimum Wage Law

Alleging that the minimum wage laws, as set forth by the minimum wage commission are null and void, and that this body exceeded its authority in establishing a minimum wage for a forty-eight hour week and a fixed compensation for time over that limit, the G. O. Miller Telephone Company of White Rock and Goodhue county, has brought action in district court seeking to have the court restrain the commission from prosecuting it for not enforcing its orders until the matter can be threshed out in court.

Contacts and Contact Material

Abstract of an Article in the "Elektrotechnische Zeitschrift"

By H. VON FLEISCHBEIN

IT is very important with the contacts on relays that the contact should be good; in fact, any contact that is used for testing or controlling purposes, in cases where the current and voltage are relatively low, must be very certain, if any reliance is to be placed on the results. Platinum is undoubtedly the best metal, since it never oxidizes under chemical or electrical action; it is, moreover, sufficiently hard, and has a very high melting point. Yet, in spite of the use of platinum, there are a good many complaints about the uncertainty of contacts.

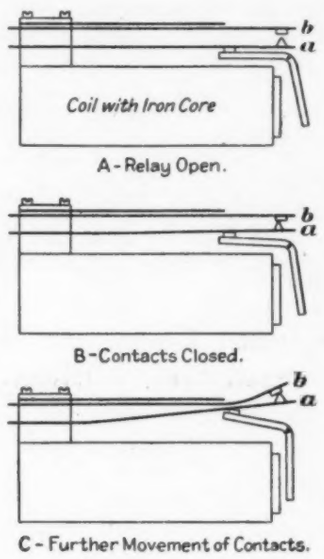


Fig. 1.

The principal causes of this seem to be that the contacts get dirty and dusty, that the contacts get burnt away, or that the contacts stick together. It is possible with great care to keep the contacts clean, and something can be done by shaping them properly. If one contact is below the other, the lower one should preferably be sharply pointed, so that dust does not tend to collect on it. If sparking can be prevented the contacts ought not to burn or stick. The spark can be entirely suppressed by placing a suitable resistance-capacity in parallel with the spark-gap, always provided that the contact is made under constant conditions—*i. e.*, that the current, voltage and rate of vibration (with vibrating contacts) remain fixed. If these things are not constant, then it is only possible to suppress the spark for some value of them, which would presumably be the mean between the extremes. It would, therefore, in the latter case depend on the conditions as to the rate at which the contacts would burn away, and a certain amount of supervision would be necessary from time to time.

A much more unsatisfactory state of affairs arises when the contacts stick together by fusion or otherwise. This may arise in the following way: The spark on opening the contact causes a sharp point to form on one of the contacts; the next passage of the current through the contacts produces such a current-density in this sharp point that a certain local heating takes place, sufficient to fuse it and to weld the contacts together at the point where they touch one another. The contacts then refuse to open in consequence of this welding together. No certain method of avoiding this has yet been discovered, but the number of cases in which this arises can be notably decreased by using rubbing contacts. The effect of dust on the contacts can also be neutralized to some extent in the same way.

A few characteristic devices of this kind may be mentioned. In Fig. 1 is is shown a contact of the kind much used in connection with telephone installations. In the position *A* the contact is open. The spring *b* is shown to be slightly stiffened on the left-hand side by a second spring, which covers the lower one to about half its length.

The contact spring *b* will therefore about the point of clamping. The lower contact *a* does the reverse, and bends along its whole length when pressed upward. The two contacts, therefore, move according to different laws, and there must consequently be a slight tendency towards a rolling movement at the instants of closing and opening the contacts. In position *B* the armature is attracted, and the springs *a* and *b* make contact with one another. In the position *C* the armature is shown to be fully attracted. Here can be seen the motion of the rubbing contact. The lower contact is noticed to pass across the face of the upper contact from left to right as the pressure between the contacts increases. The essential point to notice is that the point of contact slides, as it were. In this way the small sharp points tend to grind themselves away, and small particles of dust are removed, which would otherwise tend to form a good dielectric. And yet it has been found by experiment that, though the track of frictional contact is relatively short, it produces excellent results.

In spite of such devices, it will never be possible entirely to prevent the sticking of contacts. For years countless attempts have been made to improve contacts, and substitutes for an expensive material like platinum are much to be desired. And this last point is more than ever important nowadays, when substitutes of all kinds have become necessary. The author has lately conducted a number of tests with tungsten, and has found that it makes a very reasonably good substitute for platinum, though it can hardly be regarded as perfect.

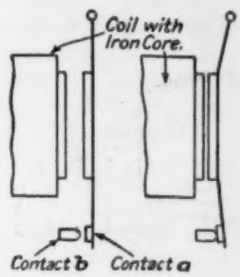


Fig. 2.

Tungsten has very peculiar properties, being very brittle at ordinary temperatures, and yet capable of being worked under the hammer at a red heat. At ordinary tempratures it is not attacked either by acids or gases. In Fig. 2 there is shown another kind of rubbing contact in connection with a vibratory movement. The experiments with tungsten were undertaken because it was found that if contacts, as shown in Fig. 2, were made of platinum, there was an occasional tendency for them

to weld together, and in the case under consideration it was essential that the contacts should work steadily over continuous periods. The current passing through the contacts varied from 0.5 to 10 amperes; there were about 20 vibratory contacts per second. A condenser and resistance were placed in parallel with the spark-gap, and the spark was thus suppressed as far as possible; but in consequence of the variation of the current it was not possible to suppress the spark entirely.

At first there were considerable difficulties about working the tungsten on account of its brittle character. Short pencils of tungsten 3 mm. in diameter were secured in collars, and used as contact *b* in Fig. 2. The other contact was made of platinum. At the end of six months no change could be noticed in the surface of the tungsten contact. The vibrating spring, which was made of steel, showed signs of discoloration; this was evidence of the existence of

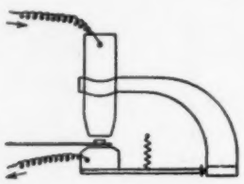


Fig. 3.

considerable temperatures. The construction was slightly altered in order to remove the heat more easily; the discoloration was not thereafter noticed.

After this, communication with the tungsten laboratory at Berlin produced contacts of the metal 3 mm. in diameter and 0.5 mm. thick, welded on to small iron cylinders, and it now became possible to make the contact *a* of tungsten as well. It was then found that two contacts of tungsten worked as well as the previous ones of tungsten and platinum, in spite of the fact that for days at a time for testing purposes the current was increased to three times its previous value. A very marked arc was formed, and yet after long periods there was no essential change in the nature of the surfaces of the contacts. There was around the contacts a slight deposit of the lower oxides of tungsten, which formed after a time; but the contact surfaces themselves remained perfectly clean.

It must be admitted that these tungsten contacts, welded to an iron support, are expensive—they cost quite as much as platinum; in spite of this, it was determined to replace all the platinum contacts. At the same time attempts were made to weld the tungsten directly to its support. For this purpose the apparatus shown in Fig. 3 was used. At red heat tungsten oxidizes on the surface. At first, therefore, an atmosphere of hydrogen was used; later, carbon monoxide was tried, to which a small amount of hydrogen was added. In this way contacts 0.5 mm. thick, and varying in diameter from 1.5 to 3 mm., were welded to springs of brass, german-silver or steel.

This welding requires some practice, as the current must be switched off at the right instant. Tungsten has a much higher fusing point than the metal of which the spring is made; the contact may in this way be pressed through the spring. The contacts carrying the current must be of sufficient size to prevent any dangerous heating. The current was supplied by a normal arc-lamp transformer, round the iron core of which there were several turns of stout copper wire. The terminal voltage at the free ends of this auxiliary winding varied from 5 to 10 volts. The main difficulty seems to consist in this electric welding; seeing that this can be overcome, the use of tungsten contacts may in many cases be regarded as a substantial improvement on the use of platinum.

It may be mentioned that tungsten is a poor conductor; it therefore heats on the passage of current and also through the formation of the spark. It is, therefore, well not to make the contact thicker than necessary. If heavy currents pass, it may be desirable to use some sort of cooling device. The method of welding by points must be regarded as a positive advantage, inasmuch as there is no difficulty in dealing with the smallest contacts.

Talk of Automatic in New Orleans

The Southwestern Bell Telephone Company may spend $2,000,000 in Mississippi and Louisiana in installing the automatic telephone system, according to C. A. Stair, general manager of the Cumberland Telephone Company. It is probable the system will be used extensively only in the business district of New Orleans and other cities.

New Central Union Home In Peoria

The Central Union Telephone Company will at once begin the erection of a $250,000 exchange building on the company's property at 119-21 North Madison avenue, Peoria, Ill. The building is to be completed by July 1, 1920.

The new building of the company is to be 60x130 feet, four stories high and of fireproof construction.

Already the contract for the equipment has been let and this includes a 20,000-line switch board. Delivery of the equipment is specified for July first.

With the completion of the new building in all probability the engineering and construction department now located at Springfield will be removed to Peoria.

Recently the company completed negotiations for the purchase of the Interstate Independent Telephone & Telegraph Company's property. This will necessitate increased facilities in the Central Union's plant and these will be met when the new building is completed.

Wisconsin Company Will Spend Half Million

At the quarterly meeting of directors of the Wisconsin Telephone Company, U. N. Bethell, New York, resigned as a director, and N. C. Kingsbury, New York, was elected to succeed him.

Expenditures of $267,000, covering additions and repairs at the Milwaukee plant of the company, and expenditures of $343,000 for similar work outside Milwaukee were authorized.

Mexicans Claim Telephone Line Was Stolen

Texas rangers, under the direction of the adjutant general's department, are making investigations into allegations made by the Mexican government through the state department at Washington that certain citizens of the United States, to the Mexican government unknown, have stolen a telephone line, poles and wires for a distance of 300 meters south of San Antonia, which is a small town lying on the Mexican side of the Rio Grande across from Candelaria.

Ownership to the line is claimed by the Mexican government, alleging that it has been used for government business.

The Preventions of Accidents

Papers Presented Before the Public Utilities Section of the National Safety Council.

Effective means of focusing the Responsibility Upon Foremen

BY J. W. EASLEY*

A DISCUSSION of effective means of focusing the responsibility for the prevention of accidents upon foremen naturally leads to an investigation of the foreman's relative position in industry, and to the methods by which can be secured his supervision to cover prevention of accidents to the end that such supervision will be a matter of assigned routine and not optional. The problem is a constructive psychological problem; a problem to secure a realization and acceptance of responsibility.

In the organization scheme of the telephone industry the foreman, because of his functional duties is probably the most potent factor in accident prevention. To a more or less extent this is probably true in all industries, but particularly so in the telephone industry because of the necessary wide-scattering of the working units; the foreman's direction is final; his judgment conclusive; he is the controlling element relatively absolutely responsible for the efficiency of his unit and the correct performance of its duties. If properly organized the foreman and his crew are working under well-defined instructions, each operation covered by standardized specifications. To make proper progress in prevention work accident prevention must be made an integral part of the operation of the unit; safety practices and safety standards must be made part and parcel of construction specifications and construction methods—and the foreman must be brought to a realization of his responsibility in this regard—then will accident prevention receive relative consideration.

Definite instructions must be issued for every operation of the crew, instructions estimated to provide for the completion of a given operation without accident, and the foreman's duties must be clearly defined to cover supervision in that direction. Output should not be a controlling factor. It should not be optional with the foreman whether a workman do this or that which may be safe or unsafe, even to hasten production. He should be specifically charged that his directions must be along the line of the fewer hazards regardless of output. As the human equation is a controlling factor in accidents, and as the mental attitude of the workman has much to do with success of prevention work, the matter of hiring and discharge should be delegated, with restrictions, to the foreman. He is in a position to judge motives and should not be hampered with workmen who are antagonistic to the safety idea. The problem of the new man on the job and his relation to accident prevention is one for the foreman's particular study. Much thought and energy have been concentrated upon improvement of method without a single new idea as to the man on the job. The foreman should be as responsible for correct instuction of safety practices as for operating methods, and this responsibility applies particularly to the new employe. Foremen should not tolerate indifference.

INSPECTION AND TEST.

Necessarily all employes should be required to inspect and test for efficiency, strength, and safety, all equipment and tools used by them. They should be instructed to do nothing contrary to their judgment with reference to their personal safety, and that when in doubt they must consult their foreman and be governed by his instructions. The foreman must be cautioned not to accept an instruction or put it into effect if in his judgment it will lead to unsafe practices. He must be encouraged to question the correctness of instructions as affecting safety. He must know that working conditions can be improved largely through his suggestions and that it is his moral obligation to make such suggestions and that such suggestions would be of benefit both to the employe and the employer. Inspection and correct instruction for use of tools and materials should be made a part of the foreman's duty. He should be made responsible for the condition of tools.

If foremen or workmen are fined, laid off or dismissed for violation ot operating rules, why should they not be fined, laid off or dismissed for failure to follow safety practices if these are to be a part of the operating rules? Dismissal of employes for unsafe practices should be delegated with restrictions, to the foreman and there should be a well-defined penalty for accidents resulting from improper supervision.

Safety inspectors should report failure to observe safe practices as carefully as the output inspector reports faulty output, and the same penalty should apply. Faulty output is checked up to the foreman, why not unsafe practices? In our plant we have tried the scheme of plant inspectors. They are appointed from the rank and file of the employes, to serve for a term of three months. Their reports are transmitted to our committee and are treated confidentially. The results have been very gratifying. The foreman are continually on the outlook to prevent unfavorable reports. But foremen must not be made too dependent upon inspection for improvement, as it hampers their initiative.

The economic loss resulting from an accident should be brought forcibly to the foreman's attention; the detrimental effect upon morale, the resulting confusion and tendency to uncertainty. The foreman should be required to make a detailed written report of all major accidents to members of his crew. He should be kept informed of the conditions of the injured person. he foreman must know intimately the effects of the accident upon the workman and his family, really to appreciate what it means. The foreman must realize his moral obligation.

The foreman must be informed of the principles of common law as they relate to his position. He should know that an employer is bound to use ordinary care to prevent injury to an employe; that the degree of diligence varies with the character of the work and that for this reason the degree of diligence in utilities is very high; that the employe, to recover damages must be free of continued negligence; that reasonable rules and safeguards must be formulated and adopted by the employer and that the responsibility rests upon the foreman to see that they are enforced and that any neglect on the

Kansas City Telephone Company, Kansas City, Mo.

part of the foreman in not carrying out the orders of his employer subjects the employer to full liability in case of injury to the employe, for reason of such neglect; that if the foreman issues proper instructions and urges caution they will tend to mitigate the damages. The foreman must realize his legal obligation.

The foreman should be well-informed as to compensation laws that may be in effect. For instance, in Missouri: he should know that compensation will not be allowed for an injury or death due to the employe's or another's willful misconduct including failure or refusal to use a safety appliance or perform a duty required by statute, or failure to obey any reasonable rule adopted by the company for the safety of the employes. He should especially know that the burden of proof rests upon the employer; that it is an accepted principle in compensation that neglect on the part of a fellow workman does not prevent recovery of compensation. If a compensation law is in effect, foremen and all other persons in supervisory positions should be furnished with a copy of the law and with the notations and explanations as issued from time to time by the commission, and they should be encouraged to discuss them at the various meetings. The foreman should be in a position to see that justice is done as relating to compensation.

The study of accidents and their causes, by the foreman, is very important. We find a very good method is to submit the circumstances and conditions leading up to an accident to each foreman for suggestions as to how the accident could have been prevented. If accidents occur the details should be given wide circulation among employes. We are employing for this work a personal letter to the employes as we question the value of the collective method—the use of the bulletin board. An effective method also of securing the co-operation of the foreman in accident prevention work is to make the discussion of accidents an important feature of the foremen's meetings. In these meetings accident prevention should be considered equally important with the discussion of other plant matters, and topics for discussion should be assigned in advance.

Spasmodic Safety Efforts and the Harmful Results

By H. M. WEBBER*

TO the experienced safety man this subject is practically answered at the start. On the very face of it, the real, honest-to-goodness safety man knows that no possible good can come from occasional efforts to bring before the employees or the public the value of accident prevention.

Whether the safety work is of the public or industrial type, the need of forceful, intensive, persistent, and systematic efforts is necessary and should be of the "hammer and tongs" variety. No one can or ever will make a success of accident-prevention work who does not continually follow it up.

To my mind there is nothing more harmful to the general safety movement than spasmodic efforts, and this is one of the primary reasons why so many companies entering into the safety work make a failure of it.

To make a start today with a blare of trumpets and possibly continue for a few weeks or a month and then forget the work for the next six months, is a decided waste of effort and a source of danger to the great safety movement. In every line of endeavor the success of the movement is conditioned by the degrees of effort that are obtained. Thus it is that the unsatisfactory results or lack of results which follow spasmodic efforts may end in the dropping of the effort on the part of the employer and will have a tendency to discourage others who may be contemplating entering into this work. We all know that properly conducted safety work in a plant means the saving of both lives and limbs, and this is true not only in our industrial plants but in public safety work as well. It means the possible prevention of an accident or death, not only to strangers to us but possibly to the members of our families.

With so much at stake in the maiming of thousands of people each year, as well as numerous deaths caused through accidents, and with the knowledge we have, that by persistent efforts in properly presenting to the employes, their families, and the public the value of the safety movement, it can be plainly seen that it must be constructive, not destructive. Spasmodic safety efforts are destructive and will tear down all of the beautiful plans you may have prepared before the movement was started.

THE NATIONAL SAFETY COUNCIL.

Does any one believe that the National Safety Council, with all of its wonderful and glorious success in the safety work, would have been any where near as effective today had the officers and management made only occasional efforts to interest the employers, employees, and the public in this work? "The proof of the pudding is in the eating" and the results attained by the council have been secured only by hard and persistent efforts on the part of the entire and most efficient management. In other words, the National Safety Council did not go to sleep on the job. They knew that the subject was a live one and accordingly went out to make the best of it. It was their persistency and belief in the value of the work in hand that helped toward the final brilliant success which they are now receiving; and only by such efforts will the safety movement be a success.

Would the railroads and other public utility companies, the steel industries and our large manufacturing plants that have made such wonderful strides in accident-prevention work have been able to make such a showing in the reduction of the number of accidents in their industries if they had not kept the work alive by continually keeping the movement before the employee in such a manner as to keep them interested? No one man can make a success of the safety or accident-prevention work without the co-operation of ever man, woman, and child in the industry in which he is engaged, and this must include the officials and the entire supervisory force. When he has secured this co-operation and all thoroughly believe that safety is a real live issue, and that lives and limbs can be saved by following out its dictates, and that the continued success of the movement depends upon each individual efforts, then and then only will the safety work in any industry become a success; yet, this success may be turned into a failure very quickly if it is not properly followed up.

*Superintendent, Department of Claims, Chicago Telephone Co.

Consider for a moment what would have been the results if only occasional efforts had been made on the part of the Allies to stop the great Germany army in its progress during the period of the war. Does any one believe for an instant that the final success gained by the Allies could possibly have been gained in any other way than by dogged persistency and determined efforts to make their entire campaign a success?

If after a brilliant start we then rest on our oars, hoping what we have done will bring forth results, we might just as well have not started, and the harmful results of such spasmodic efforts will unquestionably be shown in the lack of interest which the employes take when we again try to put the matter before them. You can't just say to employees or the public that the safety movement is a good thing; that you thoroughly believe in it and you want them also to believe in it. You have got to show them that there is something behind the movement. You must let them know that you are not alone interested in it from the company's stand point, but that you know it is for their own individual good and for the good of their families.

One of the fundamental principles of the safety movement is education. It is much more simple to teach a child than an adult, for the child's mind is always in a receptive mood and is constantly seeking information. "Train up a child in the way he should go" is an old and true saying. And in teaching safety, we must train the men the way we want them to go. It is hard, however, to teach an old dog new tricks, and so it is with the presentation of safety work to the workmen. You must put it before them in such a manner as to impress them, not only with the seriousness of the subject but in such a way that they will realize that they will be the gainers by accepting it. Show them that it is not from the standpoint of saving money for the organization which you represent that you urge them to prevent accidents, but that it is for the general interest of the individual and his fellow employes. Teach each man to be a real safety man. Show him how he can assist himself and his fellow workmen by preventing accidents, and that your interest in the work is wholly in his behalf; but that in order to make a real success you must have his individual help. Every employee has a vital interest in his fellow employee whether he knows it or not, and it is only through education that he can be brought to see the real assistance that he personally can render in the prevention of accidents.

Spasmodic safety efforts will result in the lack of appreciation of the importance of safety ideals in the plant where such spasmodic efforts are made, and cause the employees to feel that this is only one of the numerous fly-by-night fads which are constantly cropping up from time to time, so that when the real safety campaign is finally put under way, the safety man will find that he is up against a much harder job than would have been the case had the movement been started originally in the proper manner. It will be necessary for him to convince the men that the movement is one for their good, and he will be compelled to put forth greater efforts to put it across and overcome the serious prejudice which the men will have by that time taken to the entire question.

When once the employees have become prejudiced against a movement of this kind, it will be necessary for the safety man to use a much greater amount of tact and diplomacy. He will have to start a propaganda in the plant in favor of the idea before he will be able to secure their confidence.

I believe that where one company in a group has made only superficial efforts to interest employees in safety work, especially if that company has a large number of employees, the prejudice that will enter the minds of the employees of that plant will in time permeate the minds of employees of other plants in the immediate vicinity and cause great harm to the entire safety work in these plants. We all know that the greatest influence in making a shop or job safe is careful work, and hence it is that accident-prevention work is a constant battle against habits. All of us are constantly and persistently fighting bad habits that are easily formed and difficult to break. On the contrary, we are constantly trying to teach good habits that are hard to form and easy to break. However, the habit of being careful is not self-sustaining. When you start your automobile the engine roars and sputters, and every evidence of the vast amount of energy being expended is given, and yet, once the engine is started it gets under way and quiets down; but there must be a constant supply of power, and fuel, and a level head if the automobile is to be kept going. In conducting accident-prevention work a similar condition exists. In instilling habits of safety work there must be a constant supply of power and fuel in the form of inspiration, supervision, and direction. If the supply of fuel is interrupted, the accident-prevention work is bound to slow down, and may even stop, and much energy will be wasted in getting started again.

Success in safety work is comparable somewhat to the success which some of the large concerns of this country have made through the efforts in advertising, and the success in their line was not made by the placing of an ad today and again in six months, but by constant and persistent advertising. Think for a moment of the best-selling merchandise that you know of. Some of the following, no doubt, come to your mind: Heinze's 57 Varieties, Ivory Soap, Waterman's Fountain Pen, Wrigley's Gum, Cream of Wheat, etc. These names occur to you at once because of the steady and persistent manner in which the advertising was placed. You may also be able to recall articles that were extensively advertised for a short period, which are no longer on the market, and you probably can recall these names only with an effort. The purpose of advertising, then, from a sales standpoint, is to impress the names so firmly and so fixedly in the minds of the public that the name will become synonymous for that particular class of articles; so that when a purchase is contemplated the name will instantly leap in the mind of the prospective purchaser. People readily forget, however, and if advertising is not kept up the advertiser soon loses the advantage gained, and we no longer think of this particular article but simply ask for those articles as a class. The safety movement is one of constant advertising; the more the better.

During the great world war strenuous efforts were made not only by the National Safety Council but by all of the various industries throughout the country and more especially in the shipyards and munition works, to impress upon the employees the necessity for safety in order to preserve the man power of the country and thus assist in preventing the slowing up of production.

Today, with our men returning to their various vocations after spending many months in preparation for and in actual warfare, we should not relax in any way in the education of the workmen along safety and accident prevention lines. On the contrary, we should use, if possible,

greater efforts to prevent loss of life and limb, for production is needed now as much as during the war to help in the reduction of the high cost of living and thus assist in overcoming the general unrest among the working classes.

In starting the safety movement in the company I represent, we began in a small way and have kept it constantly before the minds of the employees. It was started some seven or eight years ago by first presenting the idea to our supervisory force at one of our Monday luncheons, having for the speaker a man who had been interested in the work for some time. From that time to the present we have never omitted a single day to do something to keep it alive and to keep the employees interested. Our company publishes each month a magazine devoted to the employees, which is mailed to their homes, and from the time we started the safety campaign there has not been a month that data of some kind pertaining to the safety work has not been published under the heading of "Safety and Accident Prevention." The articles are not limited to accident prevention, but also touch on subjects pertaining to the general health of the employees and their families. Our pay days are twice each month and the checks are mailed to the employees at their homes. On the first pay day a bulletin on Accident Prevention or Health accompanies the pay check, and on the last pay day the check is accompanied by a small calendar blotter on which appear short, snappy, up-to-date accident-prevention or health slogans. These calendars are never sent out in the same general form, but changed to attract attention, an we are advised that the employees and their families have come to watch for them so as to see what new thought or suggestion they contain. We have, of course, held the usual meetings on Accident Prevention, First Aid, Welfare, etc. These we call only occasionally, not frequently enough to tire the employees, but simply to keep up their interest.

Having had charge of the accident work for my company for the past twenty years, I have had occasion to study the question from all its angles and to appreciate most fully what the safety movement means and what it would have meant to the numerous employes and their families years ago, in the saving of life and limb, and how much needless suffering might have been prevented had we then had the present-day efficiency in the safety work.

From the experience in my own field of endeavor, I know that the continuous, persistent efforts we have made to keep the employees interested and advised on questions of safety have paid, and paid big, and that the results accomplished could not have been secure had we made only half-hearted or spasmodic efforts.

Theodore N. Vail Predicts Great Prosperity

In an article which recently appeared in the *American Magazine* Theodore N. Vail, chairman of the board of the American Telephone and Telegraph Company, says that he believes we are entering the greatest period of business prosperity America has ever known.

"Business has not boomed as it shortly will boom, chiefly because buyers everywhere have been following a hand-to-mouth policy. America's shelves, as well as the world's shelves, are bare of goods. The consumption of merchandise in the United States today is greater than ever before, and it soon will become greater still.

"In short, consumption is today breaking all earlier records. True, there has been more or less shifting of demand from one thing to another, and this has caused more or less complaint and hardship. But taken by and large, more business is done than we ever did before the war.

"There is not going to be any diminution, as I see it, in the purchasing power of our 110,000,000 people.

"The world must come to us for unprecedented amounts of our products. We may not sell a great deal to England, France or Germany, or other countries, for rehabilitation purposes; nor, if we are wise, shall we devote our principal efforts to securing business of this kind. Our great manufacturers and exporters are wise enough to see that these purely reconstruction orders would be temporary, whereas we can firmly intrench ourselves in Latin America, in the Far East, and in other markets which will prove permanent.

"We own at least a third of all the gold there is in the world, and the American dollar has been at a substantial premium in the principal foreign countries.

"Then what of the phenomenal growth of numbers of industries during the last two or three years? Take shipbuilding. This alone will give direct employment to many tens of thousands of workers, and will provide work for other thousands, who will supply the steel, the machinery the supplies, etc., for our mammoth mercantile fleet. Important new dye plants have been founded, and it has already been intimated that congress will probably safeguard this infant industry from attack by Germany. We have also developed our chemical industry on a large scale. Even toy making will be done to a considerable extent by our own people.

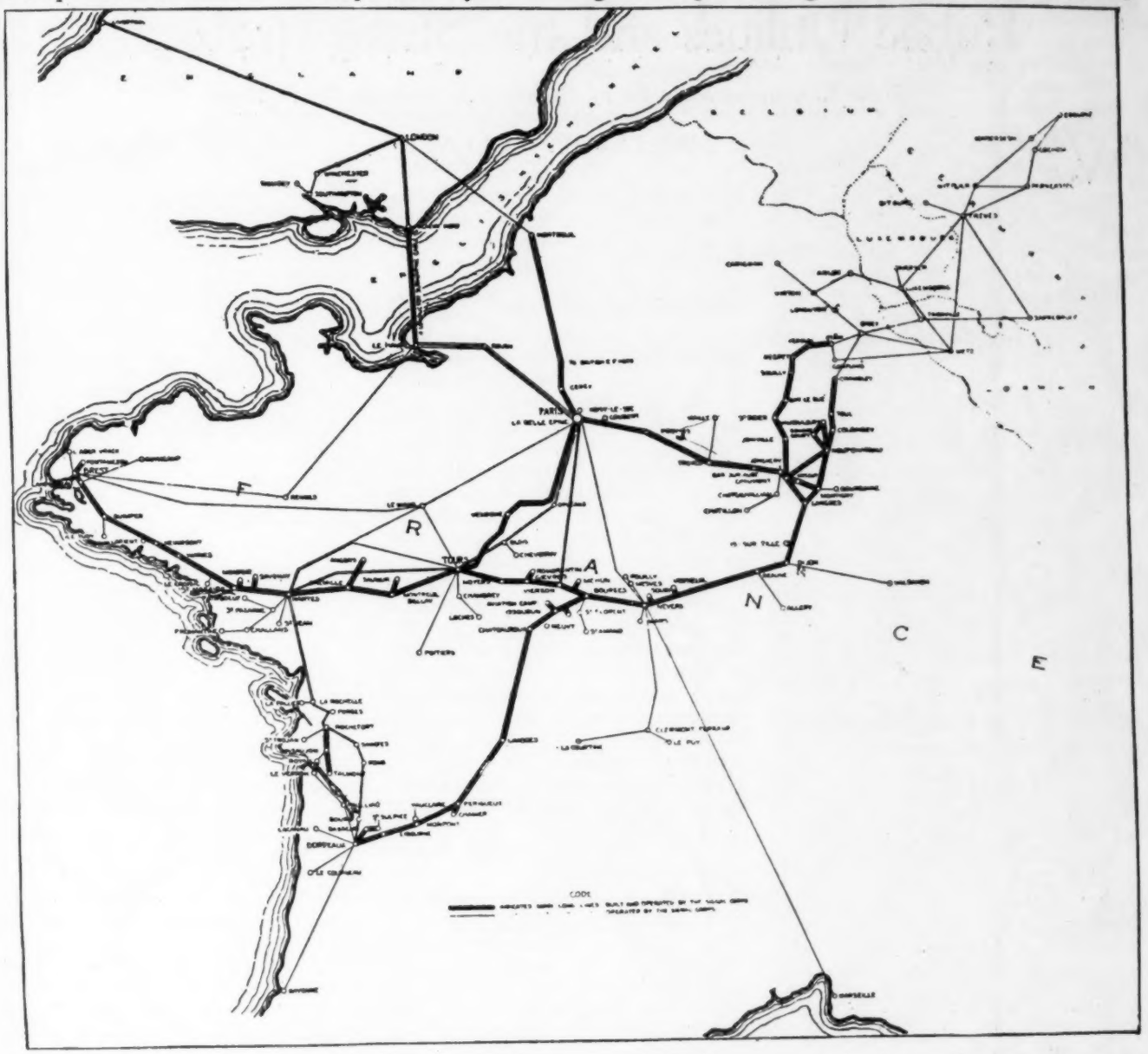
"We have, in short, all the elements for broader and better business than we have ever yet known. Things have been kept back, naturally, by the uncertainty in Europe, and also by the uncertainty here as to just what would happen to our railroads, our government-built merchant fleet, our wire systems, and other properties which were brought under the government during the war. These matters, however, are being cleared up one by one, and the business world is now fairly confident that things will be satisfactorily adjusted. Moreover, the hesitancy in business was aggravated for a time by uneasiness over the Bolshevistic activities abroad and murmurs of possible troubles in this country. Here, also, the skies have been clearing.

"Don't forget that there is nothing money dreads more than being idle. We have so much money in this country that there will be an abundance available for all sorts of new enterprises, and for the development of existing industries. Capital was held in leash, so to speak, during the war. Or, rather, it was devoted to destructive purposes. Wed capital to brains and there is no limit to what may be achieved."

Dissolves Rate Injunction In Texas

Judge James C. Wilson in Federal Court at Abilene, Texas, after hearing argument of counsel for both sides dissolved the injunction granted to the city of Abilene restraining the Southwestern Telegraph and Telephone Company from collecting increased rates, and granting in turn an injunction restraining the city from enforcing its recently passed ordinance, fixing telephone rates at pre-war figures. The case will be heard on its merits at a subsequent term of court.

Telephone Lines Built and Operated by U. S. Signal Corps, in England, France and Germany



It may be interesting to learn that this chart was reproduced from the cover of the Paris telephone directory, prepared monthly by the Signal Corps, and in this instance prepared especially for the information of the members of the American Commission to Negotiate Peace and containing an unusual amount of interesting data pertaining to the Signal Corps telephone and telegraph system.

A reference to this chart will show a well-tied-in long-line system spreading pretty nearly all over France and England, and while this system had not been developed at the armistice date, to a point where every locality occupied by the U. S. army in the S. O. S. areas was connected directly to this system, they were, however, provided with either telephone or telegraph service through the French or English commercial system wich connected with the Signal Corps system everywhere Signal Corps exchanges were located.

A further reference will show the main arteries starting from the seaports and converging at Chaumont and Neufchâteau and then towards the front areas. Tied in an important triangle are Chaumont, Tours and Paris, the main relay points in the telephone and telegraph system; and in reality this system starts within this triangle group and spreads out to the seaports and the front areas with all the main activities of every service somewhere in the main arteries net. The Signal Corps systems in France and England were connected by a four-conductor telegraph cable laid for the Signal Corps after its arrival in France, leased cable conductors from the English cable system, and land lines French and English commercial and military systems.

The long-lines system constructed by signal coils organizations at the time of the armistice consisted mostly of 6- and 10-pin leads of No. 12 copper wire, with capacities for 30 and 40 wires, built in accordance with the latest American practices, transposed for horizontal and generally for vertical phantoms and totaling approximately 3,500 kilometers of pole line on which 45,000 kilometers of wire were strung. To this must be added 5,200 kilometers of wire strung on vacant pins of the commercial systems by Signal Corps organizations and 35,000 kilometers of long lines leased from the French and English commercial systems. This total network of 85,200 kilometers of long lines was tied in at the headquarters of the armies with a network of wires extending to front areas and estimated to contain 120,000 kilometers of wire, a grand total of 205,200 kilometers or 123,120 miles. Adding local lines makes approximately 355,000 kilometers.—Lieut.-Col. E. M. Stannard in "Telephone Topics."

Public Utilities and the Strike Problem

How Engineers May Be of Possible Service to the Public

BY WILLIAMS. WOLLNER*

WHEN the employes of a public utility go on strike the decision as to whether their demands should be allowed does not rest with the utility nor with the strikers, but with the public. This is well understood by students of industrial economics who have watched the public utility pass from its role of a privilege-granted corporation, doing business primarily for the profit of its stockholders, into a franchise-governed industry doing business as a public *service* utility, *service* being the primary object of the utility; a fair profit to the owners being requisite in order to obtain the necessary capital, the rate of profit being in ratio to the need and quality of the service.

If a utility is giving reasonable service with a reasonable profit to its owners its public obligation may be said to be "balanced." But if it decreases its service and earns an undue profit, or if it increases its service and decreases its profits its public obligation immediately becomes "unbalanced." Service, as used in this connection, must be measured by its cost as well as by its actual standard of excellence. Assuming the service rendered by a public utility of any kind and its return to its owners as being balanced at the time when its employes strike for increased compensation or decreased hours of service, any or all of three things may result from compliance with the strikers' demands: either service to the public will be decreased, rates to the public will increase, or return to the owners will decrease. It is therefore wise that the final decision as to whether the demands of the strikers shall be granted shall depend upon public sentiment.

Sentiment may be the result of sympathy with the strikers' living or working conditions; it may be influenced by excellent service or lack of service by the utility, or by any one of a dozen other things. Sentiment engendered by sympathies of this kind undoubtedly influences the settlement of strikes but this cannot always be justified by economic considerations; and it is economic consideration, or the balance of public obligation, that should be the ruling consideration in the settlement of issues raised by strikes of employes of public utilities. Unfortunately, the public does not usually take the economic phase of the matter into consideration at all and swings its influence in accordance with its sympathies with or against the employes or the utility.

It is here that the engineer may step in and by giving the benefit of his trained ability to the public cause assist in making the judgment of the public conform to the facts of the case. It is obviously impossible for a single engineer to undertake a task of this kind but it is not at all unreasonable to assume that the American Association of Engineers, through its chapters, may interest itself in work of this nature and through its position influence the public toward sober judgment based on economic truths. With engineers in its membership trained in all branches of public utility service, and with valuation experts and engineering accountants there is no problem of this nature that could not be accurately solved by the association, and it is certain that in no other way could the association better fulfill its public function.

As an example of how the association might function in a case of this kind we will take the case of the employes of a telephone company who recently struck for increases of pay for operators and mechanics. The territory served by this utility covers several states and the strike of its employes entirely demoralized service in some places, greatly reducing service where it was not demoralized.

Public sympathy immediately swung to the side of the operators and was principally evidenced by action upon the part of social service workers who rallied to the aid of their striking sisters and through publicity and other means endeavored to influence the telephone company's management to grant the girls' demands. The establishment of canteens for feeding the strikers was another evidence of the trend of public sympathy, as was the demand for immediate resumption of service. It is undoubtedly true that the living conditions made necessary by the wages paid operators fully warranted this action, but the point that appeals to the practical engineer is that there was absolutely no consideration given to the necessity or otherwise of increasing rates, decreasing service, or decreasing return to owners if the demands of the employes were granted.

In order to give the public the facts to which they were entitled so that they might determine whether it was or was not necessary to provide additional revenue or to decrease service in order to comply with the public obligation to the corporation, an engineering investigation should have included: (a) a financial history of the company and its present ownership, (b) a study of operating conditions, (c) a financial study. It is assumed that the utility corporation wishing to secure its portion of public sympathy, and to obtain the necessary increase in rates if this increase was needed to meet the strikers' demands would fully co-operate with the investigators. Failure to co-operate, if given the publicity it would deserve, would certainly indicate to the public that it was necessary for the corporation to conceal facts that it should have in order to pass unbiased judgment upon the company's ability to meet the demands. Failing to receive assistance from the corporation, the investigators would still have the records of the public utility commissions and other public bodies to which to go and which should in any case be used to the greatest extent possible.

The manner in which the investigation should be conducted and the facts that should be produced would quite naturally be decided upon by the committee making the investigation, but in general the following outline would govern in a case such as the one under consideration. The ownership study should disclose whether the profit or loss resulting from the operation of the utility is spread over a large or small territory, both as to geographic consideration and number of persons. If possible it should be determined whether the profit or loss is shouldered by persons or corporations who are well able to absorb a decrease or increase in them, or whether the stock owner-

*Contributing editor of *The Monad*, published by the American Association of Engineers.

ship rests largely in the hands of investors and others who must depend upon the return they receive for their actual livelihood. It should not be overlooked, however, that in any case it is unfair to expect capital to finance utilities from which they do not receive an adequate financial return.

The service study should deal largely with its sufficiency or insufficiency prior to the strike. This study should take into consideration the various classes of service and it will probably be found that some classes have been overserved while there is room for improvement in the service given other classes. In any case the report of the investigators should clearly set forth recommendations for improvement or reduction in service. The financial investigation should show the operating results with reference to both invested capital and physical valuation of the property.

Upon completing its report the committee should present it to a meeting of the chapter, specially called to consider it, and the entire contents should be made the subject of discussion and mature consideration. When the chapter is satisfied that the report is in final shape for submission it should be given the widest possible publicity. The public would thus be placed in possession of the facts that should enable it to determine whether the economic conditions under which the company is working warrant an increase in wages without a corresponding increase in rates. It would then remain only for the public to determine whether it was willing to meet this increased cost, whether it preferred to accept decreased service, or whether it preferred to leave wages as they were.

This article is presented merely to point out to members of the American Association of Engineers what they may accomplish as an organization composed of men trained in the technical arts and sciences. One of the prime objects of the association is to serve the public and it is not living up to the purpose of its organization if it does not look about for some way in which it may serve it well.

An intensive membership campaign launched by the Western Society of Engineers, 1735 Monadnock block, Chicago, has B. E. Sunny, president of the Chicago Telephone Company, as a member of the committee.

La Porte Company Has Get-Together Day

The get-together day of the La Porte Telephone Company, at which guests from many surrounding towns and cities were present, was held October 2.

The first event of the day was held during the afternoon, beginning at 2:30 o'clock at the Y. M. C. A., where a program of speaking was held for the visitors and for those of the La Porte Company's staff who could be present.

Following the speaking, the crowd adjourned to the Princess theater, where a special program was given for its benefit. After the show, all the visitors were conducted through the local exchange and then had luncheon at the Bay Tree Inn.

In the evening, former employes of the company obligingly took the places of the telephone girls so they could go to the entertainment at Richter hall. Here, starting after 8 o'clock, there was a bit more of speaking and then the remainder of the evening was spent in dancing.

The meeting in the afternoon was attended by about thirty, mostly out-of-town guests from Michigan City, Walkerton, South Bend, Valparaiso, Chesterton, and other places near La Porte with which the local exchange has to do in the course of its long-distance business. Frank V. Newman, general manager of the company, presided as chairman.

As J. Vene Dorland, president of the La Porte Telephone Company, was called out of town, A. J. Stahl, vice-president, spoke in his place. Stahl carried his hearers back to the time when, soon after the telephone company was organized, it was on the verge of financial collapse, and was purchased by Michigan City men for $8,000. He and another La Porte man, feeling that a public service company so closely and intimately related to the city of La Porte should be owned by La Porte people, went over to Michigan City and purchased it back at an increase of $800.

"At that time," said Stahl, "we felt that if the number of subscribers ever reached 500, we would have the maximum and be satisfied. Now, however, we have 5,000 subscribers, and the building and equipment is valued at $400,000.

"With so promising a future as the company has," continued Mr. Stahl, "it was felt that absolutely efficient service should be given, and to that end Frank V. Newman was brought here from Indianapolis to manage the company. We mean to have the best of service regardless of cost!"

Following Stahl the manager spoke shortly, taking as his subject "Co-operation." Courtesy is the first essential in the telephone business, according to Newman. The company not only welcomes, but seeks and encourages subscribers to bring to the notice of the management any deficiencies of service in order that they may be overcome. One of the best ways of bringing about co-operation, not only between local operators but between operators there and in exchanges near by, is found in such meetings.

W. S. Vivian, secretary of the Nat. Telephone Association, a captain in charge of the unit of girl operators sent to France by government during the war, told of some interesting experiences during that time.

Another speaker was Norman Wolf, president of the Chamber of Commerce, who talked on the value of telephone service to La Porte and the county.

Miniature Exchange Shown at Electric Exhibit

A complete miniature telephone exchange was shown as one of the educational features of the Chicago electrical show, which opened at the Coliseum October 11.

There are 500,000 homes equipped with telephones in Chicago, yet there are few who know the slightest details of the system.

The exhibit contained switchboards, measured service and nickel service telephones, on which was demonstrated the actual path of a telephone call from the time it is originated until completed.

The numerous machines used to measure the number of calls made from telephones, machines which tell the operator when the nickel has been deposited and the busy signal device were shown.

Theodore Vail, in discussing the telephone situation, said: "You are assured that earnings of the American Telephone and Telegraph Company for the year ended Dec. 31, 1919, after full provision for depreciation, will provide for the regular 8 per cent dividend, after all fixed charges, and also permit the usual appropriations to surplus and reserves."

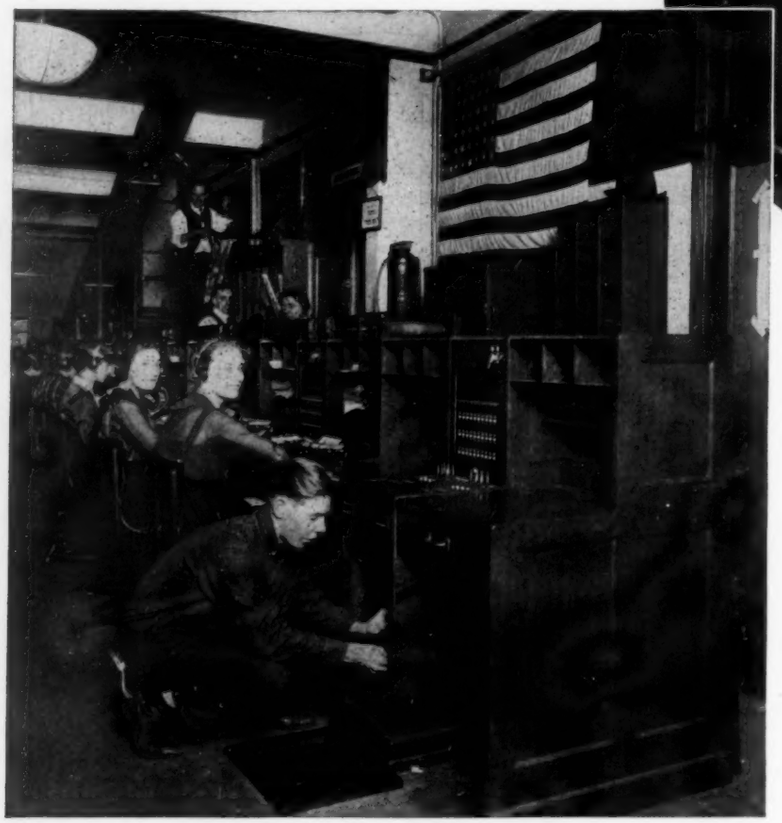
Telegrams and the Telephone

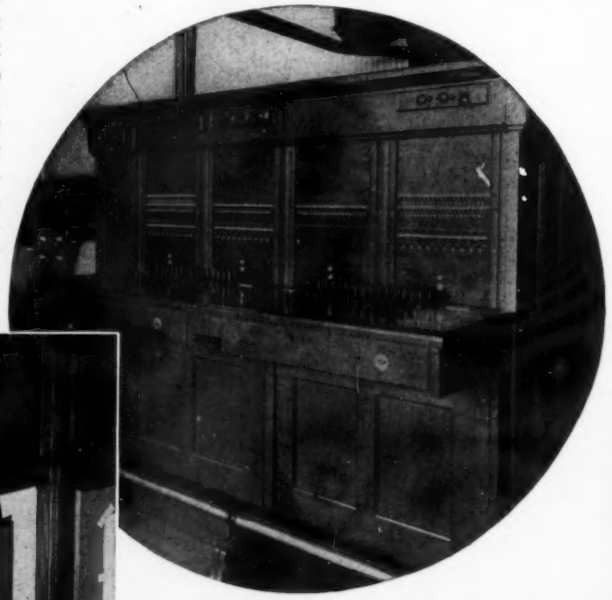
Some Western Union Equipment as Described in the "Southwestern Telephone News"

ONE day we sent a telegram; and as we did, we fell to thinging, and our curiosity was aroused. We had just spoken to a very sweet and a very business-like voice and, because of the familiar intonation, the speed, the cheerfulness and the very impersonality of the voice, we got to wondering what was happening to our telegram. Who was handling it, and how they did it? Did the Western Union office look like one of our central offices? Why, that voice sounded like the voice of one of our own operators!—a hundred other questions popped into our mind. Well, we could deny our curiosity no longer, so we started out to learn something about this Western Union business.

Telephone instinct led us to get off on a certain floor in one of those St. Louis skyscrapers, open a door and walk into a room. Say! there was nothing but switchboards and typewriters and head-sets, and the very busiest of pretty young women were present in profusion. The place didn't resemble a Bell central office, in the least, yet we sensed a peak load, the axis of distance, the spirit of service, the thrill of speed, the importance of accuracy, and we caught the hum of soft voices trained to enunciate distinctly. We also saw flitting office girls carrying endless slips of telegram blanks, and the clack-clack of multitudinous typewriter keys smote our ears. How could anyone think with all that clatter under one's very nose!

Gradually we began to dissect the conglomerate picture that lay before our eyes, and to pick out familiar objects here and there. Over in a corner we spied a newly installed P. B. X. When we went on our little trip of investigation, we expected to find a telephone or two hanging on the wall. The telegraph and telephone are rivals, of course. But there's more telephone about a big telegraph office than there is telegraph! We rather fancied, after we began putting our questions and looking around, that these telegraph relatives of ours were doing their level best to inject the telephone into their business at every place they possibly could.





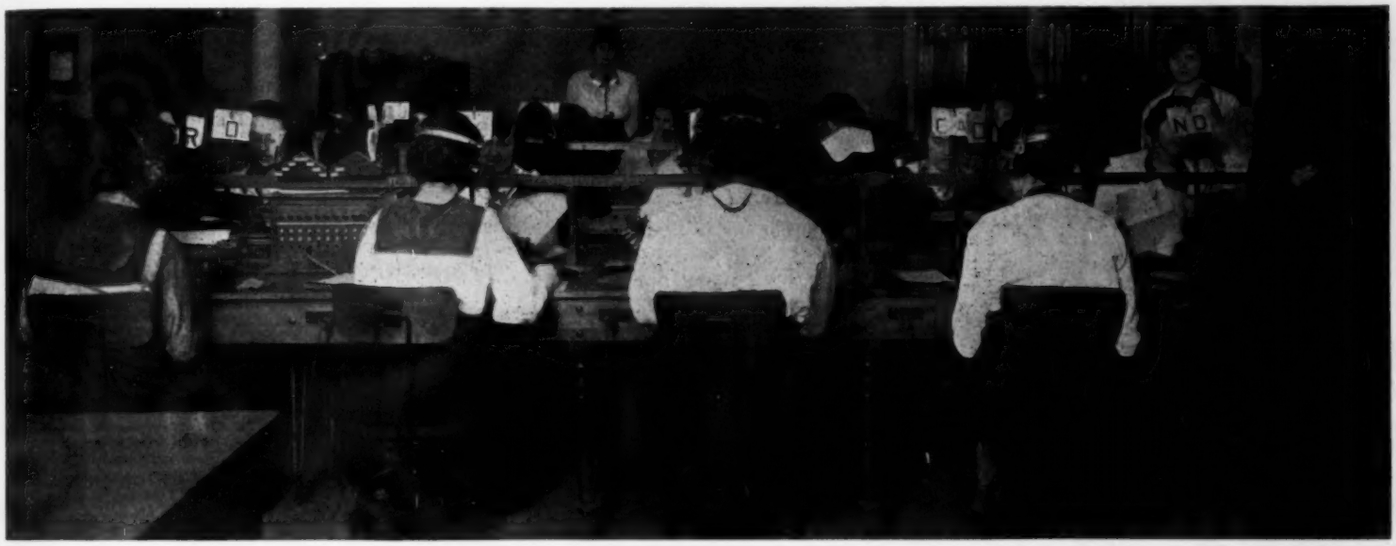
Below—Here is where the nimble-fingered operators type the messages given them by telephone. Above—The new two-position No. 4 640-line P. B. X. board.

The first object we put under fire was a twelve-position switchboard, with typewriters on the table and a rapidly moving endless belt on the top. Each of the twelve operators at the board, of course, wore a head-set. We watched. The operators would plug in, talk, listen, and pound away on their typewriters. Then, a twirl of the fingers, and the yellow slip of paper would be released from the roller and tossed skyward, only to fall on the endless belt. There it would go skimming down the room and up an inclined belt, to land heaven only knows! But we learned where later.

These young ladies, we were told, were taking telegrams. For instance, when we asked a Bell operator to give us Western Union, she trunked us right into this multiple receiving

board — a Number 602 telegram board, it is listed as—right square into an even dozen of keen-eared and nimble-fingered young ladies who typed down our message, and then bade us adieu. The board being multiple, any of the dozen could get our call. After she has tossed the typed message onto the endless belt and it has been swirled to the floor above, it is routed, that is, assigned to an operator who is handling a wire to the destination of the message. But, so far as the nimble-fingered dozen are concerned, the message ceases to be anything in their young lives the moment it lands safely on that moving belt.

And while we stood there watching, an office girl, one of several of whom had been busily dashing about the room raced up to the receiving board and harpooned a slip of the eternal yellow paper on a hook. One of the dozen seized it, plugged in—



The operators at these tables are connected with branch offices. They are typing messages over the telephone. Likewise they telephone messages to the branches.

which, of course, trunked her right into a Bell central office—and asked for a number. A moment later she was delivering a telegram by reading it over the telephone to the person addressed. We were told the message had been in St. Louis two minutes.

Next we gave the P. B. X. the once over. This two-position Number 4, 640-line board was installed by the Western Electric only recently—about the same time increased traffic led to the installation of two more positions to the receiving board. The P. B. X. is trunked to the central offices only on the Western Union's assigned number. Ask for Olive 4321 in St. Louis and you get the P. B. X. through which you can get the many stations in the building. If a person desiring to send a telegram asks for Olive 4321, he gets the P. B. X., and is promptly trunked over to the receiving board. On the other hand, if he asks our operator for "Western Union," desiring to speak to a station, he will get the receiving board, which will trunk him over to the P. B. X., and thence to the desired station.

So many persons want the Western Union only for sending a message, while so very few, in comparison want if for other purposes, that the system in vogue saves time and spares inconvenience to both company and customer. When we turned away finally from the P. B. X., we found ourselves in the midst of tables. These were not ordinary tables. On one end there was a little switchboard, and typewriters, and by each typewriter a jack. We readily discovered that the jacks were there to connect headsets with the switchboard. Each typewriter and headset, of course, owned an operator, and on stands before the operators were signs which bore such mysterious insignia as "KR," "OV," "TG," and other unpronounceable combinations. Naturally we asked the question and were told that the signs indicated what Western Union branch office in the city the operator then was connected with.

We learned that this section of the room contained operators who, by telephone, were sending and receiving messages to and from the many branches throughout the city. Suppose branch office "KR" receives a telegram from John Smith for delivery to Mrs. Smith, who was visiting her mother on the farm. "KR" would lose no time in telephoning that message to the operator at the main office who would type it and hang the form on a hook.

But it wouldn't hang there very long. One of those ever vigilant office girls would pounce upon it and hurry it over to that endless belt affair. Suppose Mrs. Smith replied to her husband's message denying him the requested permission to attend a poker party at Bill Jones' house during her temporary absence from the city. That message, of course, would arrive by code over a Morse wire or by automatic in the main operating department and be carried by conveyor to what we were told was a "router." They can call that girl anything they want to, but after we watched her work for a few minutes, we unanimously voted to call her the quickest girl in the world. She would seize a telegram, glance at the address, and then make a notation on the blank and hurl it into a conveyor, in two seconds less than nothing. For instance, when Mrs. Smith's emphatically negative reply to her husband's request reached St. Louis, the router was the first person to get the telegram after it had come off the wire.

A glance at the address, and the router designated the manner of delivery. She might write a telephone number on it (and she knows more telephone numbers than the man who writes the directory!) and send it down to the receiving board, where one of the dozen young ladies would deliver it by telephone. Again she might shoot it to the downtown de-

livery office, where it would be placed hopefully into the hands of one of those whistling messenger boys. Again she might mark it "KR" and send it merrily on its way to the branch office operators, who would telephone it to the "KR" branch office, which the router had designated as the branch nearest the address of Mr. Smith. From this branch office a leather-lunged and bicycled boy would meander forth with it to the Smith home, where Smith, no doubt, after reading his wife's ruling, would go to the poker party anyhow. And all the time the "quickest girl in the world" is routing messages at the rate of thousands a day, and seldom does she refer to a street guide or a directory.

Her speed, we are told, is attributable largely to the fact that seventy-five per cent of telegraph traffic is regular; that is, three out of every four users of the Western Union are daily or very frequently customers. It takes no time for a quick-witted person to become acquainted with this regular custom and to know how to route it. Telephone numbers stick in her mind, just as do instructions from certain customers not to telephone messages, or that telegrams may be delivered by telephone. A well-thumbed telephone directory on the router's desk indicates that it has been used regarding telegrams of the twenty-five per cent.

We were told that the St. Louis office handles an average of 2,225,000 messages a month, of which 250,000 are telephone messages. If our mathematics are correst, that is 8,333 a day, or about one every three seconds during the business hours. The average telephone peak operating force is fifty young ladies, we were told, and we didn't see a white lamp burn longer than three seconds! The moment a white lamp flashed, a red lamp, indicating that the call had been picked up, would burst into a glow. They're pretty speedy.

Naturally, the Western Union has a school where many things are taught. There is the school where operators learn routine, and how in spelling a name to say "S" for sugar, "M" for Mary, "I" for Ida, "T" for Tom, "H" for Henry, etc.

The telepgram has its standard phrases just as the telephone, and, now that the telegaph is being telephonized, the voice of the operator must be trained. Speedy and accuracy, of course, are the paramount issues. No student is permitted to sit in with a headset until she can accurately type fifty average messages per hour. And accuracy means *accurately*. A mistake is a felony in the Western Union's statute book.

One of our questions relative to the school brought forth the following interesting information. The telephone has been found cheaper and quicker as a right-hand bower of Old Man Morse. It takes four to five years to develop a first-class Morse operator, while the same number of months will turn a raw recruit into a competent telephone operator. It is interesting to know, just as a sidelight, that the telephonizing of the telegraph began in Dallas, Houston, Galveston and other Texas cities. Tried out there, and found eminently successful, St. Louis was selected as the first big city for the new system. When labor was exceptionally scarce during the war the telephone enabled the telegraph to saunter right along, despite its greately increased traffic and war hardships.

But as to the school. No student operator sees a typewriter keyboard. All are compelled to learn the touch system, and the way they can bat off messages, with their eyes fixed dreamily on a distant wall, and their ears wide open, and their minds keenly alive, is a caution!

Over in a corner of the operating room we saw a chap sitting before a dictaphone. The telegraph has to be monitored in order to call errors to the attention of indifferent operators, and to perfect and improve the service. The monitor plugs in on a busy wire, maybe one between Little Rock and Chicago—if they are routed that way—and lets his dictaphone record just what the Morse key is saying. If an error is found, it is useless for the operator to try to hedge. The monitor puts the record on for him and there he hears the harsh throaty clicks of the dots and dashes just as he sent them.

We had gone out looking for a telegraph—in fact, expecting, we might say, to find a telegraph, taking liberty with the term. Instead of finding what we sought, we ran jam into the telephone—just telephone, telephone, telephone! Where is this telephone thing going to stop?

Professor R. A. Millikan quotes an economic authority to the effect that a complete leveling of incomes in the telephone industry could not possibly increase the average income of the wage earner more than two or three per cent. Those socialistically inclined please take note.

Chicago's System of Raising Coin-Box Revenues

The nickel-in-the-slot variety constitute 72 per cent of the service subscribers of the Chicago Telephone Company. They have 55 per cent of the telephones. They contribute approximately 35 per cent of the company's revenue.

This group of more than 260,000 will have larger telephone bills if the pending application of the Chicago Telephone company is approved.

The subscribers who respond to "nickel, please," are largely flat dwellers. More than 90 per cent of the residence telephones are coin boxes.

At present the coin box renter guarantees thirty calls each thirty days. Under the proposed schedule there must be forty calls in thirty days. Both are at 5 cents a call. That works out in this way. Under the existing plan the subscriber pays $18.25 a year. Under the proposed plan he will pay $23.73 a year.

Those are minimum guarantee charges. In one case it is at the rate of 5 cents a day for 365 days and in the other it is 6½ cents.

In effect it is the system now used to encourage subscribers to talk $1.50 worth a month. That has persuaded 55 per cent of them to drop thirty or more nickels monthly into the coin box. Now the "ante" is to be raised to forty nickels.

The subscribers who will not talk forty times on the telephone in thirty days will be asked, as now, to pay for the times he has not talked up to that limit. Some subscribers now drop forty nickels monthly, but 45 per cent of them do not deposit thirty. They will have to gear up to a higher speed or pay the penalty.

There is another lever to the proposed rate machine intended to promote talking from coin boxes. Under the present system a subscriber may have put $2.75 in the coin box last month. This month he has deposited only 25 cents in the box. He is not now compelled to pay $1.25 in a guarantee this month Under the present rues he must average $1.50 in two consecutive months. Consequently, the subscriber met the requirements of the present rate regulation.

Under the proposed rule nothing like that elastic calculating is contemplated. It requires a minimum of forty calls each thirty days, regardless of what the subscriber had last month or will have this month.

The Modern Grocer's Telephone

How to Show Him the Business Increasing Possibilities of Sales by Telephone Campaigns

BY HENRY ENGARD

TWO very important problems confront the retail grocer's daily purchasing and selling. In these days of keener competition the selling end of the business is by far the most complex and the most difficult with which the grocer must cope. Buying, although very important in the successful management of the retail grocery, is usually overstressed under the delusion created by that antiquated maxim that "goods well bought are half sold." Recently, however, this old time-worn proverb has been revised to read, "Goods all sold were well bought."

There was a time in the retail grocery business when it was true that "goods well bought are half sold," but those days are past. The grocer is no longer a mere "storekeeper" waiting with full shelves for a customer with a desire for his goods to come in. He can no longer content himself with the thought that if business doesn't come today it will come tomorrow. The grocer who would be successful can not sit with folded hands and wait for trade to come to his store, he must go out and invite the public into his store.

Business today is a sort of warfare that calls for aggressiveness, alertness, initiative and push. Therefore, selling is the main problem for the grocer to solve, and it is a term that covers a score of activities. If the grocer would succeed in getting into his store every possible customer, he must be prepared to use every legimate means of attracting people in his store. No one method will appeal to all. Advertising in the newspapers will attract some, sales-letters will attract others, the window display will attract still others, while there are still other methods that will attract others that may not be attracted by adverising methods.

POSSIBILITIES OF THE TELEPHONE.

The telephone offers to the wide-awake grocer one of the most effective methods for increasing trade ever put at his disposal. Grocers are just beginning to wake up to the possibilities of the telephone as a means of winning sales and creating buying, and today scores of selling-by-telephone plans are being carried out by progressive grocers in a way that makes the bell on the cash register ring more often.

The telephone has become so common that nearly every family has a telephone in the house, and the grocer will do well to "play-up" his telephone service.

Telephone campaigns naturally differ, for they are planned and conducted so as to fit the requirements of specific situations and conditions. There are, however, certain fundamental principles upon which their success depends. First, courtesy; second, fair prices; third, good goods, and fourth, prompt deliveries. No selling-by-telephone campaign will prove successful unless these four fundamental principles are adhered to religiously.

ENCOURAGE CUSTOMERS.

The telephone can be used in a number of ways to increase trade, and the grocer will do well to encourage his customers to use the telephone, and if he follows carefully the above four principles in soliciting trade by telephone it will prove one of the most effective and profitable methods he can use.

The first thing a grocer should do when starting a sales-by-telephone campaign is to select a special clerk or clerks, as the case might be to take care of this work. This clerk should be given a special training in how to talk over the telephone, for it must be remembered that the customer at the other end of the line can not see the face of the clerk and he must have the ability to impress the customers with the desire to serve and to please through the inflections of his voice, for the same methods that are good when dealing face-to-face with the customer apply to the telephone campaign as well, only the clerk must be able to carry them out through his choice of words and their expression. This clerk should be unusually patient and courteous, and should know how to handle customers when they call to make a complaint, and thus be able to adjust the complaint satisfactorily to them and the store and hold their trade. He should be well posted on prices and the condition of the goods so that he may give the customer an honest description of them.

DON'T GIVE INFERIOR GOODS.

All telephone orders should be given extra attention and great care should be taken to see that the order is filled with the best of goods. Many grocers think that when an order comes in over the telephone it is a good chance to dispose of some inferior goods. They, therefore, lose the confidence of the customer and a great deal of trade. If the telephone campaign is to be successful particular care should be given such orders so that the customers can rely upon getting goods just as good when they order by telephone as they would if they called in person at the store.

To this end each clerk should be instructed to fill all telephone orders with the very best and never to send out anything that is not first-class. If the customer is right there to see the articles and the condition it may be in and does not object to it, that is a different matter, but customers placing their orders by telephone expect first-class goods. Whenever an article is not up to standard the customers should be called and told of the fact, and if they still wish them after knowing the condition, then it is all right to send them, but always with the understanding that should they not prove satisfactory they may return them.

ALPHABETICAL LIST.

One of the best methods of conducting a sales-by-telephone campaign is first to provide an alphabetical list of the names of all customers and prospective customers. For this purpose it is best to use an index card file, equipped with alphabetical guides, and enter each name separately on a card which will be filed on this file behind the correct guide card. These cards should be 3x5 inches and upon them should be entered the name and address, also the telephone number and any remarks that may prove of any aid when soliciting this customer over the telephone. It would be well to use three different colored cards, a white one for all regular customers; a yellow one for the occasional customers, and a blue one for prospective customers.

The different customers will have their regular days ordering their groceries and this fact must be recorded on the card so that the solicitor will call them only on the days as designated on the card. There are Mon-

day buyers, Tuesday buyers, Saturday buyers, etc. The solicitor should know this fact and never make the mistake of calling a customer on their off days. Another very important fact that must be taken into consideration in a sales-by-telephone campaign is the time of day the customer rises in the morning. Morning is always the best time for telephone solicitation, but there are customers who rise early and others who are not early risers, and the late riser does not like to be disturbed too early. Therefore the hour for calling should be entered on the card and the mistake of calling too early or too late be eliminated.

DIVIDE CARDS.

If more than one clerk is used for this work these cards should be divided and each clerk have his own separate list.

One middle-west grocer who has been using this system for a number of years reports it the best method for increasing sales he ever used. Each one of the telephone salesmen has taken great care to make a notation of any fact that would increase the efficiency of the service on the various cards from time to time.

An Ohio grocer, who is now employing three telephone salesmen, finds that a "telephone suggestion list" has helped the salesmen very materially in increasing the sales of each customer. In fact, the sales average per sale has been jumped from $1.12 to $1.67 through the use of these lists. This list is made up on a large cardboard, 14x28 inches and ruled into seven columns and each column is headed as "Canned Vegetables;" "Canned Fruits;" "Canned Meats;" etc. Under each heading is listed the various brands and prices in stock; also the price per dozen. When calling a customer the salesman suggests various articles to the customer from his list and it has resulted in more sales. By keeping account of their experiment they found that two out of every three customers purchased at least one extra article through the suggestion.

SPECIAL PRICES.

A very effective method of securing orders by telephone is to have a special of some good standard article for the day, for instance, take a regular 40-cent orange and put a price of 32 cents a dozen on it for that day only, and then have the telephone salesmen call their customers and announce this special to them and also to suggesting other articles as well. If the list cannot all be called on one morning, divide, calling half one morning and the balance the second morning. If the grocer can call 100 customers during the morning and sell 50 of them an average of $1 each, he has increased his sales $50 for the day, and if the list is large enough to furnish 100 customers for each morning of the week, he has an increase of $300 for the week, at 20 per cent gross profit, he increases his profit $60 or more than $3,000 for the year. This is nothing unusual for the grocer who carefully plans his telephone campaign and then carries out his plans. One grocer, located in a small rural community, increased his sales considerably over $12,000 during the year through his telephone campaign.

Vail Forecasts Earnings For 1919

A statement issued by Theodore N. Vail, chairman of the board of directors of the American Telephone and Telegraph Company, said:

"For the year 1919 it is estimated that net earnings will be over $57,000,000; interest charges, including that on the $50,000,000 new notes, $15,800,000, leaving a balance of over $41,200,000. During the last nine years the net earnings of the American Telephone and Telegraph Company have averaged more than five and a half times the interest charges.

"Since 1908 the amount of the company's debt outstanding has been increased less than $60,000,000, while the capital stock outstanding has been increased over $283,000,000, and the book value of the assets over $415,000,000. The company has paid dividends at the rate of at least 7½ per cent on its capital stock since 1899, a period of twenty years. For the last thirteen years the rate has been uniformly 8 per cent per annum.

"On July 31, 1919, the federal government returned all of the telephone and telegraph systems in the United States to their respective owners, including the telephone system of the American Telephone and Telegraph Company, and of each of its associated companies which with it constitutes the Bell system.

"The property has come back in as good physical condition as when put under federal control. It has been maintained according to the usual standards, the usual reserves for depreciation have been made and wages have been increased or are being adjusted to a scale suitable to present conditions. Charges for service have been generally advanced to cover increased costs.

"Under the terms of the act returning the properties to their respective owners, rates fixed by the federal government and in force on July 31, 1919, were given a legal status after the period of federal control."

Signal Corps Telephone Men Organize

Chicago Telephone Company employes who are veterans are out to make a record in postwar loyalty and comradeship. Separate American Legion posts are in the process of formation among telephone employes and these will probably be grouped as the Associated Bell posts. Veteran units are being organized among Bell employes who served in the 409th and 410th field signal battalions. These sections of the signal corps plan to enter the reserve of the United States army and a signal corps school under the supervision of the war department is contemplated. The school and reserve affiliations, however, will have no bearing on the purely civilian functions of the American Legion.

At a meeting of the Bell posts at 325 West Washington street, temporary officers and delegates to the state convention at Peoria were chosen. Heroines of the A. E. F. who served at the switchboards of army headquarters will be enrolled in at least one post of the Bell trio.

Dormitory for Operators In Detroit

The Michigan State Telephone Company, Detroit office, provide dormitory accommodations for 150 girls on the entire third floor of the new telephone exchange building at Cass and Michigan avenues.

This is being done because of the inability of girls to find suitable housing accommodations in the city. The dormitory will have 50 rooms, three beds in a room, with space provided for cooking and recreational facilities.

Detroit's telephone service is being operated under extraordinary heavy demands, with a shortage of 250 switchboard girls, according to General Manager G. M. Welsh.

Mr. Welsh declares that since schools reopened it has been impossible to employ more girls to take the place of those who returned to school.

Electromagnetic Theory of the Receiver

A Paper Presented at the 348th Meeting of the American Institute of Electrical Engineers

By A. E KENNELLY AND H. NUKIYAMA

FORCE DIAGRAM DAMPED AND FREE.

If the diaphragm is damped, any single vibromotive force (v. m. f.) f_i, Fig. 17a, will develop a counter v. m. f. f_c, which will make the resultant force zero; so that no displacement results. If, however, the diaphragm is free, there will be four forces called into action, in similarity to those in the corresponding electrical case of Fig. 15; namely, the impressed single v. m. f. f_i, Fig. 17, in phase with the flux ϕ_i; the frictional resisting force $-r\,x$ dynes, the inertia force $-j\,\omega\,m\,x$ dynes, and the elastic force $j\frac{s\,x}{\omega}$ dynes. These are represented in Fig. 17 by the vectors $O\,a$, $O\,b$, $O\,c$ and $O\,d$. Since $O\,c$ and $O\,d$ must be mutually opposite, their difference $O\,e$, combined with $O\,b$, must balance the impressed force $O\,a$. This relation determines the position and magnitude of the velocity x. We have already seen that as the frequency is changed from a small to a large value, the locus of x is a circle about O. At mechanical resonance, x will have a maximum size and zero slope, or will coincide with f_i in direction. The displacement x, not indicated in Fig 17, will always have the direction $o\,c$, 90° lagging behind x.

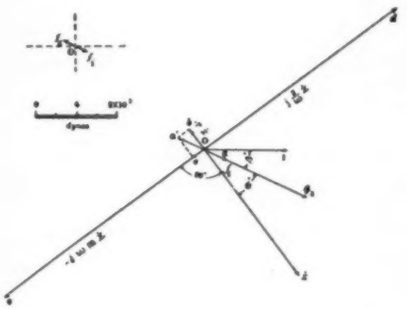


Fig. 17—Force Diagram for the Ideal Case of a Diaphragm Free to Vibrate Under a Single Impressed V. M. F. & R. M. S. Dynes.

The vector force equation is in the rotatable vector diagram of Fig. 17.

$m\,x + r\,x + s\,x = f_i$ r. m. s. dynes $\angle$ (10)

or since x is a simple harmonic displacement of the types $x_m\,\epsilon^{jwt}$,

$$j\,\omega\,m\,x + r\,x + \frac{s\,x}{j\omega} - f_i = 0$$

r. m. s. dynes $\angle$ (11)

or $-j\,\omega\,m\,x - r\,x + j\,x\,s/\omega + f_i = 0$

r. m. s. dynes $\angle$ (12)

whence

$$x = \frac{f_i}{r + j\,(m\,\omega - s/\omega)} \text{ r. m. s. } \frac{\text{cm.}}{\text{sec.}}$$

$\angle$ (13) which corresponds completely to Ohm's law in the vector simple alternating-current case.

The specific magnetic force acting at any time on the diaphragm, towards the magnetic poles, is $\frac{B^2}{8\pi}$ dynes per sq. cm., where B is the total magnetic flux density. This flux density comprises the permanent magnetic flux density B_0 gausses, and the alternating flux density B instantaneous gausses. The total magnetic force is thus

$$\frac{2\,S}{8\,\pi}(B_0 + B)^2 = \frac{S}{4\,\pi}(B_0 + B)^2$$

$$= \frac{S}{4\,\pi}(B_0^2 + 2\,B_0\,B + B^2)$$

instantaneous dynes (14). Since B^2 is very small by comparison with B_0^2, it may be neglected in the summation, and the instantaneous force in the diaphragm is

$$\frac{S}{4\,\pi}(B_0)^2 + \frac{S}{4\,\pi}\,.\,2\,B_0\,B$$

instantaneous dynes (15). The first term is the permanent force which flexes the diaphragm from its plane position, and which plays no material part in the alternating regime here considered. The second term includes the periodic quantity B, which may be represented vectorially by a vector of size B_i r. m. s. gausses, lagging $\beta°$ behind the exciting m. m. f. F_i. But $S\,B_i = \phi_i$ the r. m. s. vector flux in phase with B_i, so that in the damped condition,

$$\phi_i = F_i\,P = 4\,\pi\,N\,I\,P$$

r. m. s. maxwells $\angle$ (16) where I is the r. m. s. exciting current in absamperes, N the total number of turns including both coils, and P a vector permeance which possesses a lag angle $\beta°$. Consequently from (15)

$$f_i = 2\,B_0\,N\,P\,I = A\,I$$

r. m. s. dynes $\angle$ (17)

or in a bipolar instrument $A = 2\,B_0\,N\,P$ r. m. s. dynes per absamperes $\angle$ (18). A is a vector force factor with a lag angle of $\beta°$.

We have thus far supposed that only one periodic force f_i acts on the diaphragm. There is, however, a second periodic force introduced by the flux ϕ_x, due to the displacement m. m. f., the magnitude of which is proportional, by (6), to the maximum cyclic value of the displacement, and which has the same phase as that displacement.

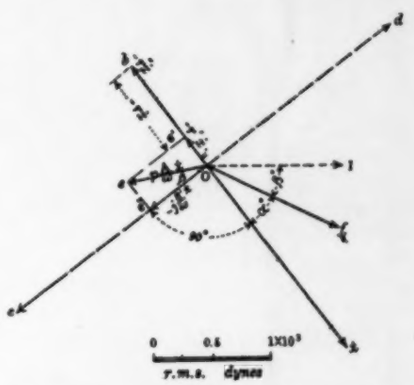


Fig. 17—Force Diagram for the Ideal Case of a Diaphragm Free to Vibrate Under a Single Impressed V. M. F. & R. M. S. Dynes. —Fig. 17a at Left.

We have already shown in (6) that the displacement m. m. f. is

$F_x = 2\,B_0\,x$ r. m. s. gilberts $\angle$ (19). This may be considered as similar to the m. m. f. of current

$F_i = 4\pi\,N\,I$ r. m. s. gilberts $\angle$ (20) so that a certain number of turns N' multiplied by the r. m. s. vector displacement, would produce the same m. m. f. as the actual number of turns N multiplied by the corresponding r. m. s. vector current. Conseqently, in the case of a bipolar receiver

$$N' = \frac{B_0}{2\,\pi}$$

equivalent turns $\times \frac{\text{absampere}}{\text{cm.}}$ (21).

If we consider the ratio

$$\frac{N'}{N} = p$$

absampere
———— (22) which, in the instru-
cm.
ment considered, was 0.168,
$F_x = 4\pi N' x$ r. m. s. gilberts ∠ (23)
and from (17)

$$f_x = p A x = 2 p B_0 N P x$$

r. m. s. dynes ∠ (24).

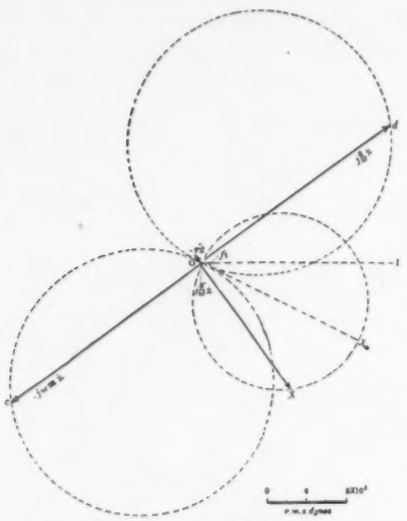


Fig. 19 — Force Diagram — Complete — Including Magnetic Force Due to Displacement.

It may be noted, in passing, that just as in the case of a vector electromagnetic inductance

$$L = A/p = 4\pi N^2 P$$

abhenries ∠ (25)
or ergs per absamp² ∠
so

$$p A = 4\pi N'^2 P$$

r. m. s. dynes
———— ∠ (26) and is a quan-
cm.
tity bearing resemblance to an inductance. From (25) and (26)

$$A = 4\pi N N' P$$

r. m. c. dynes
———— ∠ (27) so that, in this
absamp
sense, the force factor A bears resemblance to a mutual inductance.

The additional force f_x, due to ϕ_x, may be introduced into the problem either (1) by vector summation with f_i, to form a vector resultant force f, corresponding to ϕ in Fig. 6; or (2), by retaining f_i as the sole active force on the diaphragm, and introducing the action of f_x in the form of a mechanical impedance. For practical purposes, the latter method is to be preferred, just as in the simple alternating-current circuit, the effect of a counter e. m. f. of self induction is usually treated as an impedance, instead of being combined vectorially with the impressed e. m. f. in the numerator of Ohm's law.

The force f_x lags behind the displacement x by the angle $\beta°$, according to the relation

$$f_x = p A x = \frac{p A x}{j\omega} = -j p A \frac{x}{\omega}$$

r. m. s. dynes ∠ (28) or $90° + \beta°$ behind the phase of the velocity x.

In Fig. 18, the force f_x is represented in a particular case with the diaphragm free. Here the m. m. f. F_i is taken as of reference phase, with f_i lagging $\beta°$ behind it. This force f_i must now equilibrate four forces; namely, the elastic force $O\ d$, the inertia force $O\ c$, the frictional force $O\ b$, and the new magnetic force $O\ e$, whose components, along the $O\ b$ and $O\ c$ directions, are indicated as $O\ e'$ and $O\ e''$ respectively. With F_i at reference phase, the locus of the new force $O\ e$ is a displacement-admittance locus like $a\ b\ c$ in Fig. 4; but considered solely with reference to the velocity x, $O\ e$ always lags with respect thereto by $90° + \beta°$. The components $O\ e'$ and $O\ e''$ may be defined as $-r'\ x$ and $\frac{-j s\ x}{\omega}$ respectively; where r' is a virtual frictional resistance, and s' a virtual stiffness coefficient. The diaphragm therefore behaves as though its frictional resistance were increased by

$$r' = \frac{p\,|A|}{\omega} \sin B \quad \frac{\text{dynes}}{\text{kine}} \quad (29)$$

while the stiffness of the diaphragm is apparently diminished by

$$s' = p\,|A| \cos B \quad \frac{\text{dynes}}{\text{cm.}} \quad (30).$$

The value of r′ and s′ can be assigned, when A, β and p are known. In the instrument considered, at resonance, $r' = 68.8$ dynes per kine and $r = 199$ dynes per kine, r' diminishing, according to our theory, as ω is increased. Also s' is 9.3×10^5 dynes per cm. as against $s = 376 \times 10^5$. According to our theory, s' is thus only about 3 per cent of s, at all frequencies.

In Fig. 19, the loci of the inertia and stiffness forces, $O\ c$ and $O\ d$, are represented to scale, without including therein the components $O\ e'$ and $O\ e''$, Fig. 18, of the added magnetic force f_x. The directions of motion in the loci, with increase of frequency are all clockwise. The locus of $O\ d$ is a displacement-admittance locus, obtained from the circular locus of x by time integration; whereas the locus of $O\ c$ is obtained from that of x by time differentiation.

The total mechanical impedance of the diaphragm from (13) and (28) is

$$z' = r + j\,(m\omega - s/\omega) + j\frac{p A}{\omega}$$

dynes
———— ∠ (31). The reciprocal of
kine
this quantity, or mechanical admittance y' is $y' = 1/z'$

$$= \frac{1}{\sqrt{r''^2 + (m\omega - s''/\omega)^2}} \quad \tan^{-1} \frac{m\omega - s''/\omega}{r''}$$

$$= \frac{1}{\sqrt{(r + r')^2 + \left(m\omega - \frac{s - s'}{\omega}\right)^2}} \quad \tan^{-1} \frac{m\omega - \frac{s - s'}{\omega}}{r + r'}$$

kines
———— ∠ (32). The values of r'
dyne
and s' are to be taken from (29) and (30). This vector admittance y', multiplied by the constant impressed mechanical force f_i, due to the constant alternating current, gives the mechanical velocity x, or

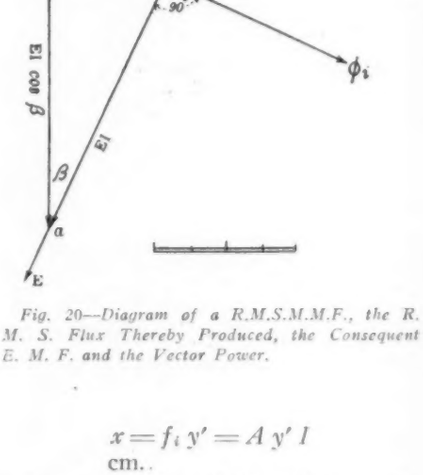


Fig. 20—Diagram of a R.M.S.M.M.F., the R. M. S. Flux Thereby Produced, the Consequent E. M. F. and the Vector Power.

$$x = f_i y' = A y' I$$

cm.
r. m. s. ———— ∠ (33) and the r. m.
sec.
s. displacement x by

$$x = -j f_i y'/\omega = -j A y' I/\omega$$

r. m. s. cyclic cm. ∠ (34). The actual maximum cyclic displacement of the diaphragm is then

$$x_m = |x| \sqrt{2}$$

max. cyclic cm. (35).

Motional Electromotive Force Diagram.—Referring to Fig. 16, the vector displacement Oc is determined by equation (34), and the vector velocity Oc in Fig. 13, by equation (33), in terms of the motional constants r, r', m, s and s', as well as A. The displacement flux ϕ_x, Fig. 8, is then obtained through (23) or

$$\phi_x = \frac{p A x}{N'} = 4\pi N' x P$$

maxwells $\angle$ (36). The e. m. f. produced by ϕ_x in the coils is the motional e. m. f. and is

$$I Z' = j\omega \frac{p A x}{N'} N = j\omega A x$$

$$= A x = A^2 y' I \text{ abvolts } \angle \text{ (37)}.$$

It may be noted that since x is a velocity in kines, the vector dimensions of A are not only expressed by dynes per absampere, as in (18) or (27), but also by abvolts per kine, as in (37).

The vector motional e. m. f. $I Z'$, Fig. 8, is leading quadrature to $O e$, the displacement flux. Since in (37), this vector is directly proportional to the velocity x, which has been shown to ravel over a circular locus, when, as in (13), a single periodic force is impressed upon the diaphragm, the motional e. m. f. $I Z'$ must also have a circular locus, as shown in Fig. 8, when the second force f_x is negligible; *i. e.*, when p in (28) may be taken as zero. When p is appreciable, the subsidiary constants r' and s' are introduced into the motional equations (32) and (33). It will be seen that s' merely reduces the stiffness coefficient s of the diaphragm by the same amount at all frequencies; but r' varies with the frequency inversely, as shown by (29). The theoretical

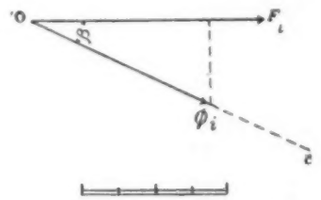


Fig. 21—Fundamental Relations of Power in a Magnetic Circuit Carrying a R. M. S. Flux ——, Under an Impressed R. M. S., M. M. F.

effect of r' is therefore to distort the locus of the motional e. m. f. $I Z'$, from a circle, to an extent depending on the magnitude of $p A$, and also upon the range of frequency necessary for the execution of the circle; *i. e.*, upon the bluntness of mechanical resonance. Since in a bipolar instrument

$$p A = \frac{B_0^2 P}{\pi} \frac{\text{dynes}}{\text{cm.}} \angle \text{ (38)}$$

an instrument which has a relatively powerful permanent magnetic flux density B_0 in the air-gaps, and also large magnetic-circuit permeance, is one in which the force f_x tends to be greatest, by (28). This, with a large value of β and a wide range of ω for executing the circle, would give rise to the largest distortion. In practice, the distortion is usually not sufficiently serious to be very noticeable, probably because the range in ω within which half of the circle is executed, is ordinarily only a few hundreds of radians per second. In the case considered, $\omega_2 - \omega_1 = 305$.

It is evident, moreover, from (37) that the lagging displacement of vector $I Z'$ with respect to I, is that of $A^2 y'$, and since, at resonance, the slope of y' vanishes (32), it will then be the displacement of A^2, or $-2\beta°$, and $A^2 = Z_0' r''$.

At resonance, the size $I Z'$, the motional e. m. f. will, by (37) be

$$I Z_0' = \frac{A^2 I}{r''}$$

abvolts $\angle$ (39).

Motional Impedance. Referring to Fig. 10, the motional impedance executes a circular locus similar to that in Fig. 8, neglecting the disturbing influence of r' at different frequencies. At resonance, its size is

$$Z'_0 = A^2/r'' \text{ absohms } \angle \text{ (40)}$$

and its slope is that of A^2 or $-2\beta°$.

From an experimental standpoint, the motional-impedance circle is of primary importance, as, from it, the motional constants may be derived, if the maximum cycle displacement at resonance

$$x_m = |x_0| \sqrt{2} \text{ cm. (41)}$$

can be measured.

Technique for Deriving the Constants A, m, r'', r' r, s'', s, p and β

(1) The motional-impedance circle is obtained from observations of the apparent resistance and reactance of the instrument, both free and damped, with constant testing current, under adjustably varied frequency. This gives the resonant maximum value Z'_0 *and its slope* -2β at ω_0 the angular velocity of apparent resonance; also the quadrantal values ω_1 and ω_2, or their equivalents.* We thus obtain the total damping constant

$$\Delta = \frac{\omega_2 - \omega_1}{2} = \frac{r''}{2m}$$

hyps per sec. (42)

and $\omega_0 = \sqrt{s''/m}$ rad. per sec. (43)

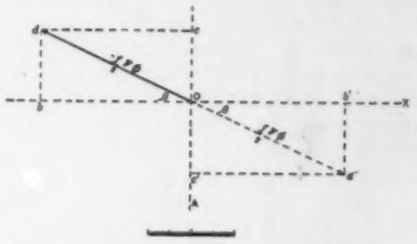


Fig. 22—Power Received From and Delivered to a Magnetic Circuit Carrying a R.M.S. Flux Lagging Behind an Impressed R. M. S. M. M. F. at Frequency f Cycles Per Sec.

(2) The amplitude of displacement x_m over the poles at resonance is measured for the measuring current I. Hence

$$A = \frac{I Z'_0}{j x_0 \omega_0} = \frac{I_m Z'_0}{j x_m \omega_0} = \frac{I Z_0'}{x_0}$$

abvolts per kine $\angle$ (44)

Then from (40)

$$r'' = A^2/Z_0'$$

dynes per kine (45)

Hence by (42)

$$m = \frac{r''}{2\Delta} \text{ gm. (46).}$$

gm. (46)

Also by (43)

$$s'' = m\omega_0^2$$

dynes per cm. (47)

Having ascertained the vector damped inductance L, at resonant impressed frequency, during the measments of damped impedance, we find by (25)

$$p = A/L$$

absamp per cm. (48)

We can then compute the value of the resistance component r' of f_x by (29) at resonance

$$r' = \frac{p |A|}{\omega_0} \sin \beta$$

dynes per kine (49)

and hence r, neglecting changes in r' with frequency,

$$r = r'' - r'$$

dynes per kine (50)

Next s' can be computed from (30) and s found by the relation

$$s = s'' + s'$$

$\frac{\text{dynes}}{\text{cm.}}$ (51)

The total number of turns N is supposed to be known, from which B_0 is obtainable through the bipolar relation

*See technique in Bibliography 17, p. 469.

$$B_0 = 2\pi p N$$

gausees (52)

The equivalent number of turns N' for computing the displacement m. m. f. is

$$N' = p N$$

absampers

———— (53)

cm.

assuming that N is a pure numeric. The quantities $p A$, F_i, ϕ_i and f_i are then easily found.

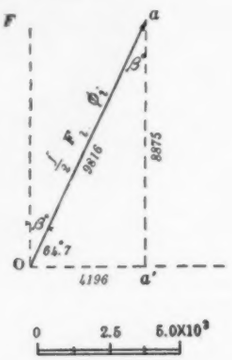


Fig. 23—Power Delivered to Magnetic Circuit at 1028 Cycles Per Sec.—Diaphragm Damped.

Motional Power. If a simple periodic m. m. f. of $F = 4\pi N I$ r. m. s. gilberts $\angle$ at the reference phase of I r. m. s. absamperes, acts upon a leackanceless magnetic circuit of vector permeance P maxwells per gilbert $\angle$, the vector magnetic flux thereby produced, neglecting harmonics, which are powerless, is

$$\phi = F P$$

r. m. s. maxwells $\angle$ (54)

The phase of the flux will have the slope $-\beta°$ of P, with respect to the phase of the exciting current and m. m. f. The e. m. f. which will be induced in the coil will be

$$E = -j\omega N \phi = -j\omega N F P$$

r. m. s. abvolts $\angle$ (55)

The power of this e. m. f., expressed electrically, is

$$P = E I = -j\omega N \phi I$$

abwatts $\angle$ (56)

the slope of I being taken as zero. The real component of P will be active power, expended thermally in the magnetic circuit, and the quadrature component will be reactive power expended in cyclically storing and releasing magnetic energy in the circuit. But (56) may be written

$$P = -j\frac{\omega F \phi}{4\pi} = -j\,(f/2)\,F\phi$$

abwatts $\angle$ (57)

where F is taken as at standard phase, and ϕ has the lagging slope of $\beta°$ with respect thereto. The negative sign attached to the expressions in (56) and (57) indicates that the power is absorbed in the magnetic circuit.

In Fig. 20, the vector m. m. f. F_i is drawn to the same reference phase as I. The flux ϕ_i, thereby produced, with the diaphragm damped, is indicated as lagging $\beta°$ behind F_i. The induced e. m. f. E, lags $90° + \beta°$ behind F_i. The vector power $E I$, taken with I as of zero slope, is $O a$. Its real component, $O b$, is dissipated. The undissipated or reactive component is $b a$.

In Fig. 21, the r. m. s. m. m. f. and r. m. s. flux are represented without reference to e. m. fs. Their vector product $F_i \phi_i$, taking F_i as of standard phase, would be along the dotted line $O c$. Taking $-f/2$ times this product, as called for in (57), we obtain, to a power scale, the vector $O d$, Fig. 22.

The cosine product of $f F_i/2$ and ϕ_i is reactive magnetic power, and the sine product, or vector product, active power liberated from the magnetic circuit. These conditions are opposite to those in the alternating electric circuit, where the cosine product is active and the sine produce reactive electric power. In order to interpret this vector magnetic-circuit power correctly, we may rotate the axis $O X$ of reference, through $-90°$, in the position $O A$. The component $Oc = -_i(f/2)\,F_i|\phi_i|\,\sin\beta$ is then the average active power, absorbed by the magnetic circuit, and liberated from it, usually as heat; while the reactive component $O b = -(f/2)\,F_i\,|\phi_i|\,\cos\beta$ is power absorbed in storing and releasing magnetic energy. If, however, we consider the vector power delivered by the electric circuit to the magnetic circuit, it will have the opposite sign to $O d$, or will be $O d$ reversed, and equal to the vector $O d'$, whose components are $O c' = +(f/2)\,F_i\,|\phi_i|\,\sin\beta$, liberated active power and $O b' = +(f/2)\,F_i\,|\phi_i|\,\cos\beta$ reactive power engaged in storage.

In Fig. 23, we have the vector magnetic power delivered from the electric circuit with the diaphragm damped. The real component is $O a'$ and the reactive component $a' a$.

When the diaphragm is free, we have the displacement m. m. f. Fx and its flux ϕ_x introduced into the magnetic circuit, as shown in Fig. 24. The resultant of these two m. m. fs. is F, and that of the two corresponding fluxes is ϕ. This magnetic-circuit vector diagram bears a close resemblance to the electric-circuit vector diagram for the simple case of an alternator driving a synchronous motor through the impedance of a connecting circuit. The m. m. fs. of Fig. 24 then correspond to e. m. fs., flux-frequencies to currents, and their respective permeance vector ratios to admittance ratios. We have

$$F_i + F_x = F$$

r. m. s. gilberts $\angle$ (58)

If we multiply this equation by the vector resultant flux ϕ, considered for that purpose as of standard phase, we obtain

$$(f/2)\,F_i\,\phi + (f/2)\,F_x\,\phi = (f/2)\,F\phi$$

abwatts $\angle$ (59)

The first term is here the vector power input P_i'' delivered to the magnetic circuit by the exciting current. The second term, reversed in sign, is the vector power P_m liberated from the magnetic circuit into pure mechanical power of the diaphragm, both active and reactive, and corresponding to vector mechanical power given to a synchronous motor in an electric circuit. The term $(f/2)\,F\phi$ is the vector power P_r'' expended thermally within the magnetic circuit in overcoming its reluctance. The equation (59) may therefore be written

$$P_i'' - P_m = P_r''$$

abwatts $\angle$ (60)

In the instrument referred to, these vector values at 1028~ were as shown in Fig. 25, where $O b$ is the magnetic input $P_i'' = 6438 \angle 36°.8$ abwatts, with an active component of 5156 abwatts, liberated both in heat and in mechanical power, and a reactive component of 3856 abwatts, engaged in the reactive storage of magnetic energy. P_m or the vector $O a$, is the power expended on the diaphragm mechanically, $3349 \angle 0.°7$ abwatts, almost entirely in the active form, nearly 3349 abwatts being developed in vi-

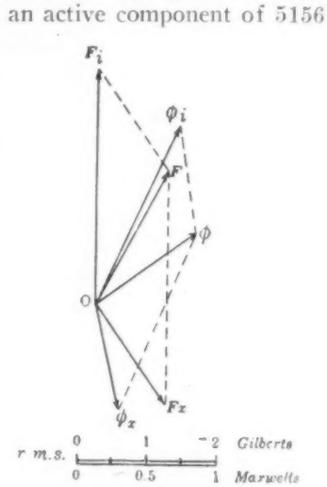


Fig. 24—Diagram of M. M. F. and Fluxes in Magnetic Circuit—Diaphragm Free.

bratory motion x^2r, against mechanical resistance r and 40 abwatts in reactive mechanical power; *i. e.*, power consumed in exchanging potential energy cyclically from the elastic to the inertia type. The vector $a\,b$ or P_r'' is the power expended in the magnetic conducting circuit by the total flux ϕ in overcoming the vector reluctance R of that circuit. At this frequency, it was 4199 $\angle$ 64° .7 abwatts, with a real component $a\,b'$ of 1795 abwatts, expended thermally in hysteresis and eddy currents. The reactive component $b'\,b$ of 3797 abwatts is expended in maintaining the activity of cyclically storing and releasing magnetic energy of the type $\frac{B^2}{8\pi\mu}$ ergs per cu. cm. in the magnetic conducting circuit.

When the diaphragm is damped, the magnetic circuit conditions are shown in Figs. 21 and 23. Here the magnetic imput at 1028 ~ is 9816 $\angle$ 64° .7 abwatts, with no counter m. m. f. of motion. The active component $O\,a'$ is 4196 abwatts, expended entirely in heat leaving the circuit. The reactive component is 8875 abwatts, engaged in maintaining the cyclic storage and release of magnetic energy.

The motional magnetic power diagram is obtained as in Fig. 26 by subtracting the magnetic power input damped P_i, from the magnetic power input free, P_i''. The difference, at the frequency of 1028 ~, is 5108 $\angle$ 79. °2 abwatts, with an active component of 957 abwatts, representing an increase of the power taken from

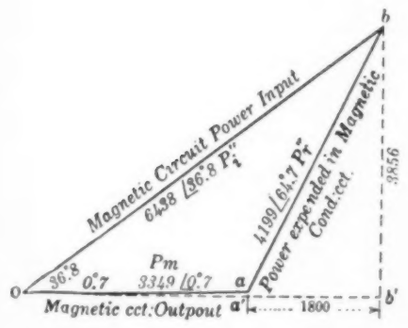


Fig. 25—Magnetic Circuit Power Diagram—Diaphragm Free.

the electric supply circuit and a negative reactive component of 5018 abwatts, representing a diminution in magnetic power of storage.

It should be observed that the active component $O\,c = 957$ abwatts is much smaller than the power $P_m = 3349$ abwatts, (Fig. 25) put into the diaphragm. The difference of 2392 active abwatts is diverted from the power previously wasted in the magnetic circuit of 4196, Fig. 23, only 1800 abwatts ($a\,b'$ Fig. 25), being

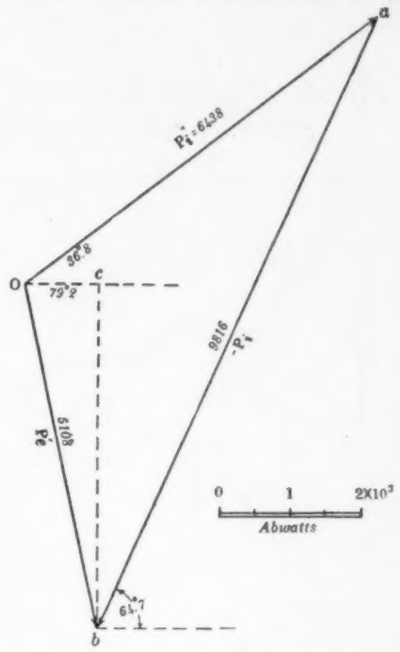


Fig. 26—Diagram of Motional Power in Magnetic Circuit—Diaphragm Free.

wasted thermally when the diaphragm is freed. Consequently, the motional power diagram does not reveal on its real axis all the power delivered to the diaphragm; but only that part which is supplied from the electric circuit. The remainder has to be made up from power saved in hysteretic and eddy loss, due to the reduction in magnetic flux by the motional counter m. m. f., especially towards higher frequencies.

(To Be Continued)

Operating Wages in Chicago

The new wage schedule of the Chicago Telephone Company has increased its yearly payments an estimated $4,026,000 since January 1, 1916. The new schedule will take about $1,750,000 from the treasury, and previous raises totaled $2,276,000.

This, without considering the high price of materials, gives a vague idea of what the company is asking in a new rate schedule.

The year of federal control is said to have run the Chicago company $1,800,000 behind.

E. H. Gary of the United States Steel Corporation made a strong point that he had increased the average income of the company's employes 116 per cent since 1913.

The Chicago Telephone Company has boosted the monthly salaries of its girls 104 per cent since 1913, according to official figures. To be sure there is no comparison between the income of a steel worker and a telephone operator, but the percentage of increase in pay is comparable.

The pay roll of the traffic department has increased from $222,000 to $551,000 between June, 1913, and August of this year. That is 147 per cent, but the number of employes have increased 34 per cent in that period.

The following table, obtained from the offices of the company, shows the pay roll for the traffic department, the number of girls, and their average monthly income for designated months back to June, 1913, to August last, when the last previous raise in wages was granted:

Mo.	Yr.	Monthly pay roll	No. of employes	Average monthly salary
June,	1913....	$222,870	5,948	$37.47
Dec.,	1913....	249,257	6,389	39.01
Dec.,	1914....	214,695	5,769	37.21
Dec.,	1915....	266,434	6,547	40.70
Dec.,	1916....	318,776	7,139	44.66
Dec.,	1917....	380,005	7,829	48.54
Dec.,	1918....	523,266	8,111	64.51
Aug.,	1919....	551,913	7,985	69.12
Last increase, estimated at.....				76.50

The new average wage increase has been erroneously stated as 5¾ per cent, according to the company. It is stated that the average will be between 10 and 15 per cent.

Gulf Storms Cost Company Hundred Thousand

J. E. Farnsworth, vice president of the Southwestern Telegraph and Telephone Company, issued a statement in which he placed the loss of the telephone company in the Gulf storm at more than $100,000. "The damage to our properties extends from the Louisiana border to Brownsville on the Rio Grande," Farnsworth said. "As usual we were able to restore our long distance service before other wires were working. The heroism of our operators in the stricken cities of Brownsville and Corpus Christi was remarkable. Those in Galveston were no less deserving of praise. The girls at the switchboards worked for almost three days continuously."

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

By FRED W. SCHOLZ

Results of Electrification of French Railways

THE October issue of TELEPHONE ENGINEER carried an abstract of an article written by a French engineer concerning the influence of electrification of the French railways on the telegraph and telephone system, whose wires run parallel to the tracks. We now come to the second part of the discussion, which covers troubles caused to the telephone service through the interference of the railway lines.

Troubles of Service—(a) Interruption of Service: The electromotive forces induced in the telephone lines by the traction system may be strong enough to make the various protective devices along the lines operate. Either a fuse may be melted, or, if the discharge passing over a lightning arrester is sufficiently strong, it may cause a permanent grounding on the line at the point where the lightning arrester is located. The telephone line thus affected will be either broken or grounded. At any rate, it is useless for further communication until the protective devices are returned to their original state. If the protective apparatus affected is at or near a telephone exchange the trouble is easily remedied. But if, on the contrary, the troublesome spot is located at some distance away from the exchange, it will take considerable time before repairmen can reach the location of interrupted service and make proper repairs. Under these conditions telephone service will remain interrupted for a long time.

It may happen that the working of the lightning arrester does not cause a complete grounding of the line, but merely decreases the insulation of the line. It may also occur that the electromotive force induced by the traction line is not sufficient to make the protective devices operate, but is sufficiently large to break through the insulation at any one point on the line or at any of the telephones connected to the line. Under these conditions the insulating resistance may become insufficient and telephone or telegraph service difficult.

(b) Faulty Calls:—The alternating current voltages (at 25 periods, for example) induced between the two wires of a telephone circuit and earth may, if they have a sufficiently high value, operate not only the call bells or call annunciator discs connected between the wires and earth, but may also operate the bells connected between the two wires of the line, thereby causing a discharge between the electrodes of the lightning arresters. The telephone bells can naturally also be operated equally well by the voltages induced between the two wires of the telephone line, provided that these voltages has a sufficiently high value. It takes from 8 to 10 volts to ring an ordinary telephone bell.

When on a single-phase traction line of 25 periods an accidental short circuit is produced, it is not at all rare to have hundreds of telephone bells rung along the telephone line which runs parallel to the tracks, and there have been cases where subscribers' bells have rung, situated some miles away from the line. The result is that every subscriber whose bell rings lifts up his receiver, and when these false calls are rung in the middle of the night or very early in the morning, the temper of the subscribers is not of the best and complaints pour into the office in large volume.

(c) Telephone Noises: We know that it takes a power smaller than one-tenth of a microwatt in a form alternating with the frequency of the human voice to produce a sound audible in the receiver of a telephone instrument. In the long telephone circuits within large cities, and on fair size long distance connections, the energy which is received at the telephones under normal conditions is very close to the minimum required for good communication. Under these conditions a foreign noise, due perhaps to induction from the railway line, slightly perceptible to the ear of the telephone user, may cause considerable trouble in preventing clear hearing or communication, and may depreciate the value of a long distance conversation to a very large extent, by making the two subscribers unable to communicate with each other in a satisfactory way.

The trouble thus caused depends largely on the frequency of the disturbing currents. A traction current with a fundamentally low frequency of 16 to 25 periods in general produces only very little disturbing noises. But it may happen that a wave under some other influence is distorted, perhaps through the saturation of the iron in the transformer, or through the harmonics of the armature teeth of the motor, whose frequency depends on the speed of rotation of the motor. If such conditions prevail it is not at all uncommon to have noises produced on the line which are intense enough to make all other conversation impossible.

2. *Destruction of Material*:—*(a) Fire Danger*: Owing to the necessity of terminating a very large number of wires within a limited space, it is impossible to use for telephone and telegraph lines the same thickness of insulation and the same safeguards that are used in insulating and protecting wires used for transmitting light and power. Therefore the insulating resistance of conductors used for telephone and telegraph service is usually very slight. Voltages of 200, or even smaller voltages, especially if they originate in external sources of fairly great power, as is the case in traction lines and in current induced by traction lines, furnish a fire risk which must be watched with great care.

In general the real fire danger to telephone lines from currents induced by traction lines is greatest at the moment of a short circuit on the traction lines. However, it may be possible that these induced voltages may decrease the dielectric resistance of the telephone lines sufficiently and cause a melting of the safety fuse or a breaking of any electric arc that is formed.

(b) Magnetization of Pupin Coils: The use of Pupin coils on long distance telephone lines is necessary for long underground cable lines, and of advantage both for short cable lines and for long open overhead lines. The good functioning of a Pupinized line depends on the inductance and the effective resistance of the coils being rigorously constant and always kept within the specifications determined by theoretical computations based on past experience. Now,

all the currents, both direct and alternating, of an intensity greater than that of the telephone currents are susceptible to a magnetizing action of the Pupin coil cores. This means that the magnetic state and especially the magnetic permeability of the iron of these cores is changed. Generally the result is a decrease of the effective resistance and of the inductance of the coils.

Let us study this phenomenon of magnetization, which is of major importance to proper communication over telephone lines operated alongside a traction line. Let us consider a Pupin coil whose windings, connected to a battery in series with a rheostat, can be charged by a direct current of increasing intensity. Let us measure first of all the inductance L_0 of the coil, before any appreciable current has traversed these coils. We will call this inductance the initial inductance at the zero point. Let us suppose that we have to deal with a Pupin coil whose core is made up of soft iron wire of an initial magnetic permeability of $u^0 = 65$ and let us suppose that we find $L_0 = 250$ millihenry at 800 periods. This is the value which the inductance of the coil must retain in telephone transmission. Let us then draw a graphic picture, using for the abscissa the successive values of the direct current which is progessively increasing and as ordinate the corresponding values of the ratio $\frac{L}{L_0}$ expressed in %. We will then obtain the curve shown in Fig. 1.

We will observe first of all a growth in inductance of the coil in comparison with the initial inductance which the coil possessed when its core is not magnetized. But this increase rarely passes beyond 5% of the initial value and is followed quite quickly by a decrease, which is at first very slight but then goes down quite rapidly, shown by a sudden drop, ending at a well defined minimum value. This minimum value corresponds to the magnetic saturation of the iron of the core of the Pupin coils. For the type of coil considered this minimum value will be about 65/100 of the initial value L_0. For other types of Pupin coils the space within which inductance varies in the course of magnetization will be frequently much smaller. These changes in inductance are due to changes of the magnetic permeability of the iron of the cores. Now we know that the losses in iron through hysteresis and through Foucault currents depend also on the permeability, and consequently we have magnetization also changing the value of the effective resistance of the coil, an effective resistance which takes into consideration the losses in the copper and the losses in the iron. In general the changes in resistance are in the same sense as the changes in inductance, but the changes of effective resistance are of a much greater amplitude than those of inductance.

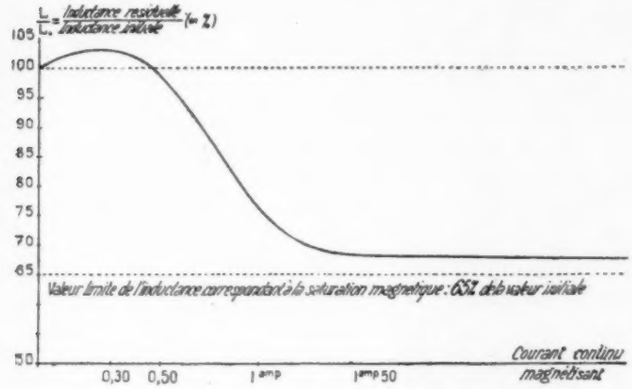


Fig. 1. Curve for Pupin Coils.

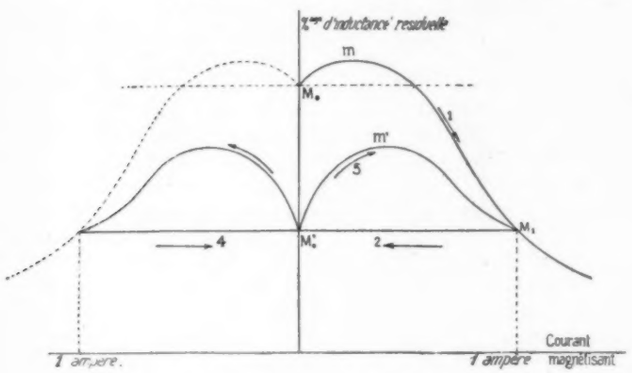


Fig. 2. Curve of Pupin Coils.

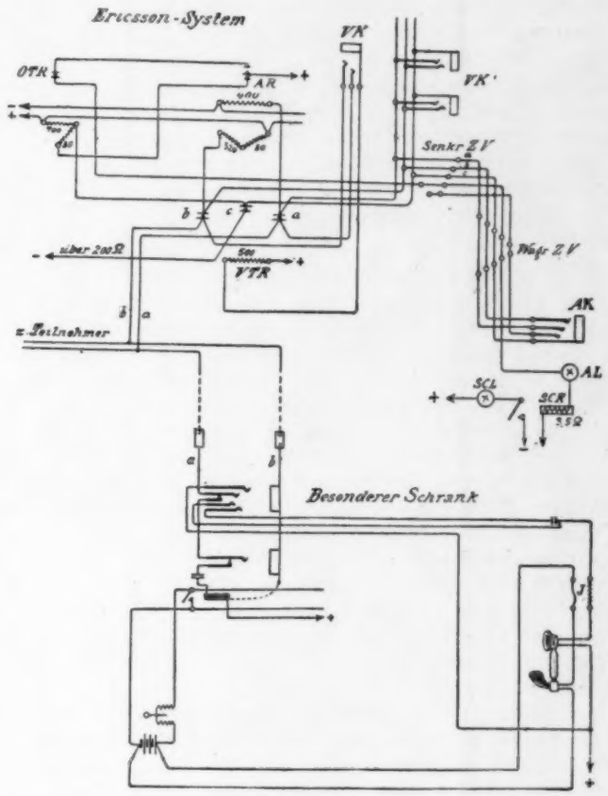


Fig. 3. Wiring Diagram for Plug-Switchboard.

Let us suppose now that we take a coil identical with the one just used, but not having as yet been magnetized. Let us then introduce into its wire coils a direct current which we will cause to increase from 0 to 1 ampere. After each of the elementary changes we will measure the residual inductance and we will then be able to trace the curve of the variations of the inductance in the course of a cycle of magnetization. This curve will have the aspect of that shown in Fig. 2.

This curve is very interesting, for it shows in a fair way the disadvantage of magnetization of the core of

a Pupin coil. Let us suppose that a new coil, whose normal point of functioning is M_0 has been magnetized under the influence of a continuous current of 1 ampere. This is equivalent to saying that in Fig. 2 we have passed through the arc M_0M_1. When this parasitic current has ceased the coil will go back to the point M'_0 and not to the point M_0 any more, its inductance having been considerably decreased, which is the first disadvantage. But let us suppose now that a second current equally parasitic and equally positive, varying from 0 to 0.5 ampere, comes and disturbs the telephone circuit. We will now have a new magnetization curve represented no longer by the curve M_0mM_1 but by the slightly different curve $M'_0 m' M_1$. Consequently we we can draw our conclusions that once a coil has been magnetized, relatively slight disturbing currents will produce very important changes in the inductance of this coil.

It is almost impossible to demagnetize Pupin coils once they are in position. More often it is necessary to replace them by new ones and to send the others back to the factory to have them demagnetized there by sending a current of changing positive and negative direction through the coils, giving to the currents a changing decreasing intensity. But if a parasitic current of great intensity has passed through a Pupin coil it is generally impossible to demagnetize it completely and to reduce the permeability of its core to its normal state. From this time on coils thus exposed become useless for long distance traffic. Considering the rather high price commanded by such coils there accrues to the telephone administration an expense which makes their use on lines exposed to traction influences very high.

3. *Accidents to Persons*: (*a*) *Electric shocks*: At the moment of a short circuit on the traction line, and perhaps also at the moment when interrupters or other apparatus on the traction line operate, the neighboring telephone lines may receive an electric shock sufficient to cause injuries to telephone users or to workmen busy with repairs on the lines. The probability that these shocks may cause very serious accidents to persons on the lines are in truth very slight. But it is a fact nevertheless that these shocks are a real source of complaint on the part of telephone employees and even of subscribers, and that the latter consider the use of telephones whose right of way leads along traction lines a risky matter.

Accoustic Shocks: The electric discharges induced in the telephone lines, even though they may not be strong enough to cause electric shocks to persons on the line are nevertheless great enough to cause very disagreeable and loud noises in the telephone receivers. The telephone operators who have the receivers constantly at their ear are of course most subject to this trouble and the causes of complaint on their part are not at all unjustified. The rapid and sudden passage of these electric charges through the coils of the receiver attracts and repels the receiver diaphragm violently, which produces a short and loud clicking noise, which is always disagreeable and may even be dangerous to the eardrum.

4. *Results of Experience*: Such are the different ways in which magnetic induction due to neighboring traction lines manifests itself on telephone lines. The processes employed in eliminating these disturbing factors or at least reducing them have been described in numerous publications. The French engineers have turned for advice to American engineers, and the article by H. S. Warren on "Inductive Effects of Alternating Current Railroads on Communication Circuits" read before the American Institute of Electrical Engineers in August, 1918, and appearing in Telephone Engineer for September, 1918, has been their chief source of information. As this article is available to every reader we will not go over the deductions made from it by the French engineers.

The conclusions reached by the French engineers are of interest. Basing them both on the experience of our American engineers and on their own limited experience with the operation of traction lines parallel to telephone lines, they say that it is very difficult to operate lines of communication in a satisfactory manner, where they run parallel with traction lines. Single phase and triphase lines act equally bad. In the case of direct-current traction the danger from magnetic induction is less, but another factor enters in and that is the danger of electrolysis. There seems to be no way of eliminating the disturbance due to traction lines by the usual methods. Even placing the telephone lines a good distance away from the electric railways and using lead covered cables for telephone lines are only partially successful. Coöperation between the electric railway engineers and the telephone engineers is an absolute necessity, and only thus will this present day problem of communication be solved in a satisfactory way, if the two branches of the electrical industry work hand in hand. *Annales des Telegraphes et Telephones.*

Elimination of Plugs in Multiple-Switchboard Operation

ALL telephone exchanges, whether large or small, have frequent changes in the condition of the lines leading to the various subscribers. For example, a subscriber may call for an exchange and the telephone number "123," and if this line has been disconnected for some reason or other, the calling subscriber will have to be notified by the operator of that fact, so that he will not lose more time in waiting for his connection. If the subscribers has been given a different number instead of the one he called, that fact must be announced to him also, and so ad infinitum. In order to give to the operator the chance of giving her subscriber information quickly, telephone exchanges have used wooden plugs to dose up jacks that were not open to telephone traffic. These plugs have different characteristics. Some of them have round, some of them three cornered, some of them square heads. Others again are colored in various colors. Each of these forms or colors has a specific meaning, and the operator knows at once why the line cannot be used, as soon as she sees a certain plug in the jack. *E. g.*, a plug with black head means—the line has been disconnected; a plug with green head—the subscriber is out of town; a plug with red head—connection is disconnected owing to non-payment of telephone charges; a plug with white head—the connection has been changed owing to removal. In this latter case the new number is printed on the white head, enabling the operator to give the new number to the calling subscriber. By combining colors and shapes any number of signals may be indicated on these plugs.

Each multiple field, however, must have the same plug in the same jack coresponding to those in other panels, in order that the same information may be given to the subscribers by all operators, busy at the various multiple switch-boards. In an exchange of moderate size with ten multiple fields—one multiple field extends over three operators' places—there would have to be one plug in each of the ten jacks corresponding to the number 123 which has been disconnected as we assumed above. If we add the assumption that this number has been changed to 1001, we would have to have ten different white plugs, each with the new number sticking in the ten jacks at the ten different multiple fields.

In the larger exchanges, where there there are switchboards with still more multiple fields, the number of plugs to be used increases tremendously. Then again different seasons will bring with them additional burdens in the watching of plugs. For example in the fall and in spring, when tenants move and have their telephone connections changed, the work of the operators would be exceptionally heavy along lines. The need for plugs for larger exchanges at this time would mount up to 1,000 to 1,500 plugs. As these plugs must be marked with various numbers, or must have the heads covered with different colors, etc., such an exchange must have a regular plug department, where the plugs are prepared for service. In addition a plug register must be kept at the exchange, showing the nature of the plug, the number to be used, the date when inserted and the reason. At the switchboards it frequently happens that plugs are removed during service or that plugs are inserted in the wrong jacks, and there must be an inspection service which will prevent trouble from such sources.

Aside from these drawbacks there is also a reduction in efficiency in exchanges where this plug service is in vogue. In multiple operation the necessary information is given directly by the operator who receives the call, but in exchanges where the A-operator receives the call and passes it on to the B-operator, this information can be given only after some delay. The subscriber gives his number to the A-operator and the latter connects with a trunk wire service by the B-operator and transmits the required number to the latter. The B-operator informs the A-operator of the number of connecting trunk to be used by the A-operator, say No. 12, and uses plug 12 in the multiple field. She finds that the jack asked for has a white plug inserted. To give this information to the subscriber, the B-operator has to connect herself with a special "information" operator. She uses the plug of line 12 and connects the subscriber to "information." The latter will ask the subscriber for his number, looks up the trouble and then gives the desired information to the latter. All this takes time and is not conducive towards good and efficient telephone service.

Most of this trouble can be eliminated if a special switchboard is installed at some convenient place, perhaps at the "information" desk. This switchboard is used for connecting all the subscribers whose lines are cut off, or changed, or plugged in any way in the usual manner. The connection must be removed away from the regular multiple switchboard and transferred to this temporary plug switchboard.

All of the lines starting from the main distributing frame should be connected to the a- and b-terminals of the special switchboard and there connected to drops. The drops should be so marked that they show at once the reason for the transfer. The multiple jacks on the regular switchboard now remain unplugged. Now if subscriber "123" is required at any of the panels, the operator immediately plugs the jack in question, and as this line is connected to the special switchboard, the operator at the same receives the call. The operator announces herself as "Information" and informs the calling subscriber at once of the reason for the non-connection or the change in connection. This type of operation aids in speed, certainty and efficiency. Additional time is gained, since the A-operator or the operator at the multiple board need not take the time to give extra information which she will often not have at her finger's end. Moreover she need waste no time in looking for plugged jacks, as there are none, even the plugged ones being open to the usual treatment. Time is also gained for supervisor's service as there is no more need for watching the proper position of the plugs and the general inspection service of that department. The service gains in certainty and assurance, since all such calls are concentrated on one special plug-switchboard. There is no chance of multiple jacks being plugged by error, as frequently happened with the old system in use. Where the connections terminate at call lamps instead of at drops, the connotation is still simpler, as the various meanings can be placed on the lenses over the lamps. The number of calls to be used depends on the locality and service, whether there are numerous changes or not. The wiring diagram shown in Fig. 3 gives the wiring to be used for connection all disconnected lines or lines to be plugged to this new special switchboard. The system employed is the and does not need further comment. Ericcson system, which is well known All details can be seen from the diagram.—*Fernsprech Technik.*

Regeneration of Dry Cells

SOME telephone exchanges especially in smaller towns and rural rural districts use a great many dry cells and batteries, and the following article dealing with the regeneration of these used batteries may be of interest. According to practice in many of the continental countries the dry batteries were exchanged when the terminal voltage after a two minute test dropped down to 0.8 volt, when using a resistance of 10 ohms. The war, however, necessitated economizing everywhere and it was not Germany alone that saw itself forced to resort to substitutes, but some of the smaller allied countries as well. Switzerland likewise was confronted with a great lack of the raw materials that go into the construction of dry batteries, as well as lack of workingmen for those factories. In many instances the batteries were left in operation even after the test showed them to be below 0.8 volt. It was only when telephone communication became practically impossible that the various exchanges thought of replacing the batteries. The scarcity of materials showed another surprising fact. Cells that showed as low as 0.1 and 0.2 volt were of course useless, but above that figure they gave fairly satisfactory results, at least on exchanges having traffic within narrow limits. The time limit for some of

these batteries was as high as three years. When a cell has given that length of service we may say that it has served its function well. In order to regenerate the electromotive force again, an attempt was made which proved successful in many instances.

The following method was used. Pure distilled water was sprayed into the dry cells through the openings left to let out waste gasses, using a glass liquid sprayer. The cells whose voltage showed no increase after such treatment were again charged electrically. If no result showed even then, another trial was made with the same cell, using the dry charge method. In some cases cells, which before treatment showed only 0.2 volt terminal voltage after four years service, showed after treatment 1.0 volt. Another case showed even better results, the voltage rising from 0.2 before treatment.

The wet treatment was made as said before with a glass water-jet sprayer or a glass syringe. Water was sprayed into the gas escape openings of the cells until the element could not absorb any more water. Care must be exercised in doing this, so as to prevent the cardboard shell of the cell becoming wet and falling apart. The subsequent electric-charge treatment lasted 20 minutes. A charging curent of 1.5 amperes was used. The positive pole of the cell (the middle electrode) has to be connected with the positive charge wire and the negative pole of the cell must be connected with the negative charge conductor. Should the cell get heated during charging, the process must be interrupted, as the cell will otherwise become useless for any service.

It was shown that some of the cells reacted better towards treatment with water alone, while others required a subsequent charging with dry electric charge. Since most European countries unite telegraph and telephone service under one administration, and since both services use a very large number of batteries, the value of such a regeneration policy is evident from the standpoint of longer service and greater economy.—*Fernsprech Technik.*

The school of electrical engineering of Purdue University, Lafayette, Indiana, is offering a short course in telephone practice, starting November 17 and continuing until December 12.

Indiana Association No Longer "Independent"

The Indiana Telephone Association is a new organization formed at a joint meeting of the Indiana Independent Telephone Association with the Central Union Telephone Company at the Claypool Hotel in Indianapolis last month. The old Independent organization let down its bars against the Central Union, and from now on the interests of the reorganized association is to be conducted for the general telephone good in Indiana, regardless of the old-time conflict of the Independent and Bell interests. H. A. Barnhart, former congressman from the Thirteenth district, and a newspaper man, is president of the new association.

The other officers elected to serve for the ensuing year are: First vice-president, W. W. Harbaugh, Sullivan; second vice-president, Samuel Tomlinson, Plymouth; secretary, F. O. Cuppy, Lafayette; treasurer, Max F. Hosea, Indianapolis; Mr. Hosea also serves as the editor of the *Telephone Bulletin,* and state organizer. The executive committee includes W. M. Bailey, Richmond, H. F. Farwell, Terre Haute; Walter J. Uhl, Logansport; Frank E. Bohn, Ft. Wayne, and Frank Wampler, Indianapolis.

The fifteen members of the board of directors are: W. M. Bailey, Richmond; Frank E. Bohn, Ft. Wayne; J. A. Browne, Winchester; H. F. Farwell, Terre Haute; W. W. Harbaugh, Sullivan; M. F. Hosea, Indianapolis; F. R. Parrett, Princeton; C. R. Stoops, Appanee; F. R. Strickler, Franklin; Samuel Tomlinson, Plymouth; Walter J. Uhl, Logansport; F. O. Cuppy, Lafayette; W. L. Bott, Rensselaer; Frank Wampler, Indianapolis, and H. A. Barnhart, Rochester.

New State Company Sold to Iowa Bell

All property formerly in the possession of the New State Telephone Company, Sioux City, Ia., has been sold to the Iowa Telephone Company. Amendments to the articles of incorporation of the New State Telephone Company now allow the dissolution of the company by a vote of the majority in amount of stock of the corporation.

The New State company formerly operated long distance lines to Cherokee, Ida Grove, Sioux Falls and other towns. It had no lines in Sioux City. The Sioux City Telephone Company, in whose building the New State Company has offices, has no long distance lines outside the city, but has used the lines of the New State Company. The Sioux City Telephone Company will continue to use the lines now owned by the Iowa Company.

Iowa Company Making Improvements

Operations to improve the system of the Iowa Telephone Company to cost over $10,000, have been started in Burlington, according to a statement by C. T. Huebner, manager of the company. This work, which will consist largely of the placing of many miles of cables underground, will also aid much in developing the service in Burlington.

Work has been started in laying underground cables from the offices of the company at Fourth and Columbia streets to Fourth and South streets and then to various sections of South hill. It is also planned to install an underground cable to North hill.

The installation of the cables will permit the placing of many telephones, ordered during the past year, but which the company was unable to install through shortage of material. Scores of citizens have been unable to secure telephones owing to this condition. It will likewise result in relieving overload on overhead cables which will do much to improve service.

Grand Rapids Merger Means Improvements

Building an addition to the present main exchange building of the Citizens Telephone Company, enlarging branch exchange buildings and installing a new switchboard are among the probabilities which will result from the taking over of Michigan State Telephone Company's properties by the Citizens Telephone Company of Grand Rapids.

According to officials of the Citizens Company, it will take at least a year and a half after the agreement between the two companies is signed to bring about the physical consolidation of the properties.

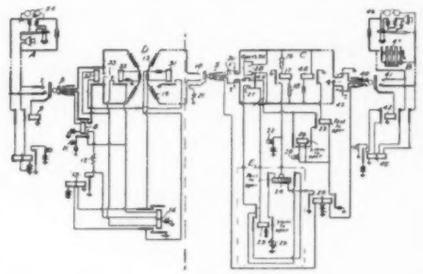
It is added that subscribers need not worry about higher rates than at present charged by the Citizens Company being asked prior to completion of this consolidation, as existing rates are likely to continue for at least a year and a half.

Telephone Patents Recently Issued

A Brief Digest of the Most Interesting Current Specifications

BY DAVID S. HULFISH

NO. 1,308,910. Telephone system for railway trains. Issued to John M. McIlhany and Ernest E. Kitts, Bluefield, W. Va. This is a system for communicating between the several cars of a railway



1,312,773.

train. Each car has a telephone set with loud-speaking receiver, the loud-speaker being aranged to speak into the air pipe of the air-brake system, and a transmitter being arranged to receive sounds spoken from other cars of the train into the air pipe. There is no electrical connection between the cars, the speech transmission from car to car being through the air of the air-brake pipe.

1,309,231. Automatic switch. Issued to E. W. Adams, assignor to Western Electric Company, Inc., New York, N. Y. This is a small switch suitable for line switch or linefinder. The contact bank is a cylinder and the brushes are power driven inside the cylinder. The novel feature is found in the manner for controlling the movement of the brushes. The contact tags are staggered and the brushes move in zig-zag movement, stopping at every contact. It is essentially a non-numerical switch, for conditions where searching is required.

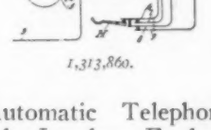
1,309,248. Identifications System. Issued to C. L. Goodrum, assignor to Western Electric Company, Inc., New York, N. Y. In an automatic telephone system, the called party is able at will to lock up the central office switches so that they can be released only by the central office attendant, who thus may identify the calling line before releasing the switches.

1,309,304. Line Switch. Issued to J. N. Reynolds, and J. F. Hern, assignors to Western Electric Company, Inc. New York City, N. Y. This is a line switch for serving a large group of lines and a smaller group of trunks. Each line has a rotating bar and each trunk has a rotating bar, both bars with contacts. One idle trunk rotates its bar ino operative position, and the first calling line rotates its bar and engages the trunk bar and moves the trunk bar back to normal while holding electrical engagement with that trunk. The next trunk bar then rotates into operative position and awaits the next calling line.

1,310,730. Semi-Automatic System. Issued to W. G. Blauvelt, assignor to American Telephone and Telegraph Company, New York, N. Y. The operator's circuit, instead of being a bridge upon the cord pair, is a loop which is cut into the cord pair with a twelve-point switch. Controlling keys of any desired nature are included serially in the operator's loop circuit.

1,311,156. Automatic Test for Manual Cord Pair. Issued to H. D. Currier and H. H. Ide, assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. The conductors to the ringing plug are open in a relay in the cord pair; a test relay is connected to the sleeve of the ringing plug. The ringing plug is inserted into the jack of the line asked for, and if the test relay shows that the line is idle, then the other relay connects the two plugs together for conversation.

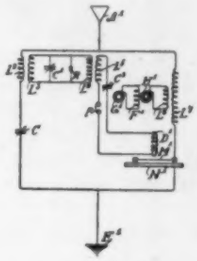
1,311,432. System of Multiplying. Issued to William Aitken, assignor to



1,313,860.

Relay Automatic Telephone Company, Ltd., London, England. In a linefinder system, where the total trunks are greater in number than the number of trunks available to any one line, a system of permutation is offered in the connection of the trunks to the line switches, such that the total efficiency of the trunk group is increased.

1,312,504. Thermionic Telephone. Issued to Van Lynden, assignor to American Thermophone Company, Boston, Mass. One feature in the construction of a thermo telephone is to provide for the rapid cooling of the thermal element. In this patent, a substance which is a conductor of



1,313,570.

heat but a non-conductor of electricity is placed in contact with the conducting wire which constitutes the heat element of the telephone, thus acting to cool the wire rapidly when current is not passing.

1,312,514. Linefinder Switch. Issued to J. G. Blessing, assignor to Automatic Electric Comapny, Chicago, Ill. A small switch of single movement of selection. The brushes are driven over the contacts by power of an electromagnet, and the driving dogs and ratchet are so arranged that when not in use the brushes stop between sets of contacts. There is no normal position for the brushes.

1,312,688 and 1,312,965. Meter Service. Issued to John Erickson, assignor to Automatic Electric Company, Chicago, Ill. When the called party answers, a relay at the central office reverses the current upon the calling line. The reversal operates a relay at the calling telephone which prepares a meter at the calling telephone to register, the actual registration being made when the calling telephone is hung up.

1,312,733. Recall Signal. Issued to R. S. Wilbur, assignor to Western Electric Company, Inc., New York, N. Y. Relays are added to a manual cord-pair, in connection with a commutator, so that when the called party to a connection has operated his hook lever once, his lamp is caused to flash continuously and repeatedly until the connection has been taken down, restoring his control to his own line lamp.

1,312,778. Tri-party Connection. Issued to H. P. Calusen, assignor to Western Electric Company, Inc., New York, N. Y. In an automatic telephone system, the called party to a connection is able to operate a searching switch to pick up a selector switch, after which he may operate the selector switch to call another line, thus making possible connection and conversation among the three telephones, and inasmuch as the party last called may always be able to call another, it follows that all the members of the sewing circle may be connected together for a good old four hours of gossip any rainy afternoon.

1,313,406. Vacuum-Tube Repeater. Issued to R. C. Mathes, assignor to Western Electric Company, Inc., New York, N. Y. The arrangement is the usual circuit, except that two or more vacuum tubes are used in multiple.

1,313,570. Substation Circuit. Issued to B. D. Willis, assignor to Automatic Electric Company, Chicago, Ill. This circuit for an automatic telephone substation set does not close the line circuit when the call sender dial is pulled, unless the telephone is off of the hook at the time.

1,313,861. Radio Relay Circuit. Issued to John Hays Hammond, Jr., Gloucester, Mass. Radio messages are received at a determined frequency upon an antenna, are translated into varied direct current, are retranslated into radio curent of another frequency and of increased volume, and are retransmitted from the same antenna.

1,314,214. Automatic Switch. Issued to J. N. Reynolds and J. F. Hearn, assignors to Western Electric Company, Inc., New York, N. Y. A selecting switch to select three figures of the directory number. The first movement of the switch selects a contact bank; the second movement selects a row, and the third movements selects a contact in that row.

Chicago Company Talks on "Wages of Capital"

The Chicago Telephone Company has issued a statement to its customers on "the wages of capital," showing the effect that inadequate rates would have in the face of present extraordinary conditions in all lines of business on development work which must be done in order to provide for the future.

"After being in business for about thirty-two years," says the statement, "the Chicago Telephone Company, on January 1, 1910, had a property the book value of which was $30,659,590 and 262,359 telephones in service. In the ten years since then the book value has increased $51,180,000, or 167 per cent, and the number of telephones has increased 394,733, or 150 per cent.

"Vastly more was accomplished in the last ten years in the development of the telephone service in the territory of the Chicago Telephone Company than in the thirty-two years preceding. The development of the telephone business must not be allowed to stop. It must keep step with the industrial growth of this country.

"The next ten years will require for new buildings, switchboards, poles, wires, cables, instruments, etc., at least twice the amount of the new capital expended during the last ten years and this large sum of money can be secured from the people who buy bonds, stocks and notes only after they have been convinced that they can safely invest in the company's securities. We must pay the wages of labor, and must pay the wages of capital. If we pay the wages of labor and fail to pay the wages of capital, we can go on for a time with what we have, but we cannot grow, and the industry will come to a standstill.

"Telephone rates is the answer. They must be sufficient to pay the wages of competent people to do the work; provide material for repairs and maintenance; replace wornout property; pay taxes and other expenses and pay the wages of capital —the interest and dividends on the bonds, stocks and notes of the company issued for money to pay for the plant employed in the service of the public."

Telephone Equipment for Brazil

Practically the whole of the telephone lines in the State of Rio Grande do Sul are owned by one company, whose headquarters are in Porto Alegre. In the three largest cities—Porto Alegre, Pelotas and Rio Grande—the exchanges were equipped by the Siemens-Schuckert Company, but the switchboards are antiquated and require renewal. Extensions are also required in other towns, and English manufacturers would do well to keep an eye on the Brazilian market for telephone apparatus. According to the English "Board of Trade Journal," the central battery system is used at Porto Alegre, but at Pelotas, Rio Grande and other places the subscribers ring by hand, and the induction system is in use. The capacity of the Porto Alegre board is 10,000 lines, and there are 5,000 subscribers; the Pelotas switch board has a 5,000 line capacity, and there are 2,000 subscribers; and the Rio Grande switchboard has a capacity of 2,000 lines with 500 subscribers. Other cities, such as Bage, Caxias, Santa Cruz, Sao Leopoldo and Cachoeira, have exchanges, and the total subscribers for the entire state reaches a high figure. The company is making plans for the installation of an automatic exchange in Porto Alegre, and when this is effected the material replaced by the more modern equopment will be transferred to the smaller cities.

It is reported that many of the telephone exchanges in other Brazilian towns are in need of reorganization or extension. Some plant is being obtained from the United States.

Brofos Takes Big Order In Copenhagen

Word has been received in New York that Einar A. Brofos, sales engineer for the Western Electric Company, Inc., at Christiania, Norway, has obtained from the Copenhagen Telephone Company an order for two semi-telephone exchanges. These will be made by the Western Electric Company, Inc., the manufacturers of telephone equipment for the Bell system, and will cost about $10,000,000. One exchange will have as its central station the town of Amagar and the other will be located at Hellerup.

The obtaining of this order is a distinct recognition of the superiority of American made telephone equipment. Western Electric systems have been in operation for some time in France, Norway, Sweden and Holland.

Cumberland Company will Spend Eight Millions

Installation of additional telephone cables to furnish more complete service to the residents of the outlying areas of Knoxville, Tenn., which have been taken into the greater city, will be one result of the expenditure of $8,000,000 by the Cumberland Telephone and Telegraph Company on its lines throughout the country.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

Western Electric Company's Fiftieth Anniversary

Half a century of continuous existence is no new thing in American business, but the significance of such a life in the electrical industry is indeed great because, properly speaking, the electrical industry belongs to the present generation of men.

In November of this year the Western Electric Company celebrates the fiftieth anniversary of its birth. It began in 1869 as a small two-man concern, founded by Elisha Gray and Enos K. Barton. The firm was known as Gray & Barton.

As the telegraph was practically the only application of electricity which had been brought into any considerable commercial use in 1869, undertaking to manufacture electrical apparatus required not only vision but indomitable faith and energy together with sound business sense. Mr. Barton had these qualities and sensed the opportunity which was offered when he took over the Cleveland shop which the Western Union Company had decided to abandon. Soon after, the new concern moved to Chicago.

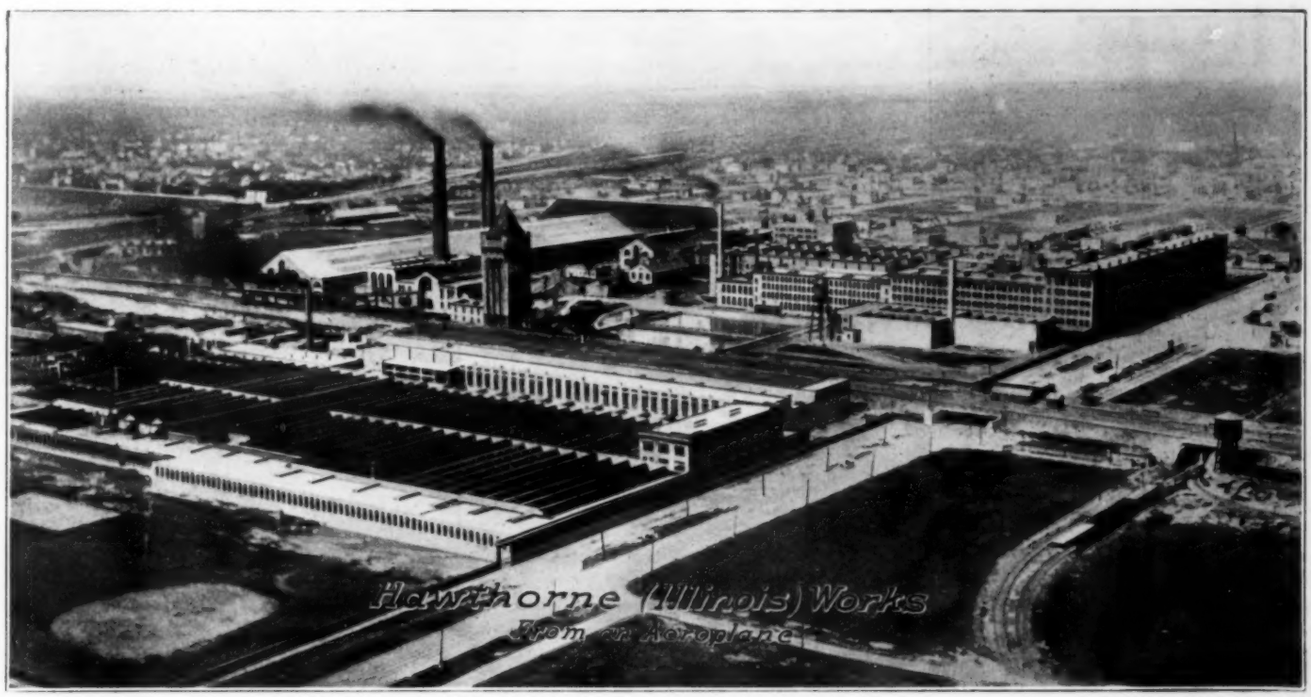
Before the day of the telephone the little shop manufactured telegraph apparatus, signal boxes, registers, annunciators, call boxes and fire alarm apparatus. After the advent of the telephone in 1875 the company was busy making equipment for the exchange of the Western Union Telegraph Company. In 1879, the retirement of the Western Union from that field gave the control to the American Bell Telephone Company. This company had hitherto purchased its telephones from competitive manufacturers, but, recognizing the superiority of the equipment made for the Western Union, it entered into a contract with the Western Eelectric Company which provided that the latter should make all the telephones for the American Bell's use.

The needs of this service quickened the inventive genius of the company's engineers and brought a corresponding and ever increasing expansion of its volume of business.

The common battery lamp switchboard of today was evolved from the crude switchboard of the early seventies, the attractive desk stand telephone from the cumbersome box type. The paper-insulated lead-covered cable solved the problem of the necessary increase in the number of open wires as telephone service became popular, and the establishment of transcontinental wire communication and transoceanic wireless communication solved the problem of long distance transmission. In the telegraph field the multiplex printer is an achievement of the Western Electric engineers in coöperation with others.

To meet an ever increasing demand for products which it did not make, the company bought such goods of the makers and resold them to the user. Out of this early relationship of buyer and seller has evolved the largest electrical jobbing organization in the world, operating from forty-two distributing houses. These houses perform a two-fold function. By virtue of the supply contracts with the American Telephone and Telegraph Company and associated companies, they supply all the apparatus and supplies needed by these companies, thus effecting tremendous economies as a result of being able to purchase greater quantities than each individual company could.

Further than this, each distributing house maintains large stocks of materials and electrical appliances for every possible electrical need. It is prepared to supply materials for buildings pole lines; for equipping and wiring homes, offices and factories,



and for supplying electrical appliances for simplifying housework.

The company also maintains a large manufacturing plant, built at Hawthorne, Illinois, in 1903. This plant is constantly being enlarged to meet the fast increasing needs of the telephone manufacturing end of the business. The employees of this plant, together with those from the forty-two houses in the United States and the foreign houses, constitute a working force of over 30,000 men and women.

The telephone was an American invention and to the Western Electric Company belongs the credit for having the foresight in 1879 to lay the foundations for an enduring business in foreign lands.

At the present time it has associated companies in Belgium, Switzerland, Argentine, Norway, South Africa, England, Italy, France, Australia, Japan and Holland, and allied companies in China, Russia, Austria and Hungary.

The Western Electric Company played a prominent part in the World War. It has been said by experts that the American Army could not have functioned without the modern telephone system which was built in France between the front line and the sea coast. The multiplex printing telegraph was put to the test in handling the armies of the allies in the air, the company did notable work in the development of radio telephony, particularly as applied to communication between airplanes and the earth, while on sea, in addition to the great practical utility of the radio telephone from ships to the land, and from ships to each other, the submarine detecting equipment as developed by engineers both here and abroad undoubtedly was an important factor in defeating the submarine peril.

Apparatus was likewise developed for use in the locating of enemy artillery fire, and equipment for use in the listening posts, in advance of the lines.

In addition to its work on telephone apparatus, the company was able to serve the government in conspicuous fashion by assembling and shipping to the other side large quantities of electrical supplies of every character.

At the same time the foreign allied houses manufactured large quantities of equipment—which were used by the allied armies.

A Useful and Distinctive Labor Saving Tool

Labor saving, time saving, production improving machinery and tools are fast becoming dominating factors in all industries.

The humble jack, in the form of the

Lifting a Pole with the Simplex Jack.

No. 328 Simplex pole pulling and pole straightening jack, occupies the distinctive position of being especially intended for and successfully operating under all conditions of pole construction and maintenance work.

It was designed at the suggestion and with the assistance of engineers and other officials of the leading telephone and telegraph companies in the country, for the express purpose of pulling and straightening poles for telephone, telegraph, electric light, power and railway companies, municipalities and other public utilities having pole equipment.

Patents pending on this jack have recently been allowed, with broad claims, and will shortly be issued.

So successfully does this jack handle every phase of their construction and maintenance pole work that several hundred such companies throughout the country have adopted it as standard equipment.

As indicative of the great economy accompanying this unusual jack's service, it is claimed that with it one or two men can pull the largest pole whatever the depth, soil or season conditions, in a fraction of the time it takes the usual gang of five or six men to do the work. Also one man with this tool is said to straighten a pole in one minute, that usually takes several men several minutes to perform.

This jack is constructed of the very best materials and along rugged lines, and so designed that in both raising and lowering its operations are so perfectly controlled as to insure absolute safety—to pole, overhead lines, and other equipment and operator. Its various exclusive and distinctive features, above outlined, equip it to safely, economically and efficiently handle every phase of the varied, extensive and exacting pole operations of the largest public utility companies.

The high cost of labor in their construction and maintenance operations is causing public utility companies to give, more than ever before, serious attention to more economical and effective ways and means of meeting these high maintenance costs.

In this service the No. 328 Simplex jack mechanism is proving itself a "friend, indeed, in time of need," by heavily reducing the labor and other costs, at the same time very materially increasing pole handling efficiency all around.

Those concerned in public utility pole construction and maintenance work, who are not conversant with this unusual tool and the niche it has carved for itself in public utility pole efficiency and economy, will find it a most interesting and instructive subject.

The Simplex No. 310 emergency jack is another tool of distinctive and exclusive design—very similar to the No. 328 pole jack—and which is adapted to an almost unlimited range of general utility service. Like the No. 328 Simplex above described, this jack operates to any angle at full capacity. This exclusive service ability in connection with its several different lifting and pushing points and attachments, enables it to meet any and every emergency that comes within the scope of jack service. In fact, so perfectly adapted is this jack to moving every object that needs to be pushed or lifted, that it well may be termed the jack of a thousand uses.

The manufacturers of these jacks, Templeton, Kenly & Company, Ltd., Chicago, will supply interesting and instructive information and literature on either or both of these jacks.

"Give Him Tools That Are Right"

Four old acquaintances coöperate in a strong bid for telephone business.

The Western Electric Company, acting as distributor for Oshkosh, Klein and Buhrke, recently launched a heavy circularizing campaign that blanketed the telephone field with timely literature on the subject of tools. The "broad-sides" pertinently direct the field's attention to a novel

plan whereby a complete stock of high-quality tools from the hands of these three "old reliables" will be kept on hand at forty convenient points of shipment.

The folder, which quickly catches the eye and holds it, impresses the reader with the many advantages of choosing from a complete stock of suitable and reliable tools. The inside spread of the folder contains interesting views of these products during process of manufacture and is supplemented with short educational paragraphs.

A map spotting the forty Western Electric distributing points shows the prospective buyer at a glance his proximity to the complete stock of the three brands. A postcard enclosed in each folder makes it easy to order and encourages promptness in mailing.

Stromberg-Carlson Sales Force Changes

E. P. Schafer, who for many years traveled the state of Indiana in the interests of the Stromberg-Carlson Telephone Manufacturing Company, resigned recently to accept a position as secretary of a large fertilizer concern in Omaha. His place has been taken by A. M. Roberts, formerly Nebraska salesman for the Stromberg-Carlson and the old Garford Manufacturing Company. Mr. Roberts is an experienced telephone man who possesses both rare ability and a pleasing personality. His qualifications and training should be of great assistance in making a success in the territory to which he has been assigned.

Michigan is now being covered by C. F. Sanders, formerly with the Chicago installation department of the Stromberg-Carlson Company. Mr. Sanders has had a wide experience in all phases of telephone work and is thoroughly competent to give his customers and prospective customers an unusual degree of service and real help in solving their telephonic problems.

A new member of the Kansas City sales force is George Ferguson, who recently returned from France with a D. S. C. For the past few months George has been working on private telephone installation sales and dealer service work at the Rochester office. His place at Rochester is being filled by Louis Foulkes, Jr., a new member of the organization who has been advanced from the advertising department.

Booklets Tell Why Kellogg Equipment Is Good

In response to a large number of requests for a brief compilation of some points of superiority of Kellogg equipment, the Kellogg Company have just published two booklets, one covering telephones and the other switchboards.

The booklet on telephones discusses each piece of apparatus used in the making up of both desk and wall telephones.

New Kellogg Booklets.

In a clear, non-technical manner, it describes the method of manufacture, the materials used and why they are best for the purpose, calculated to make the reader understand "Why Kellogg is Best," which incidentally is the title of this booklet.

The booklet on switchboards describes the new Kellogg standard No. 150 magneto switchboard. This board is carried in stock, equipped with 30, 50 and 100 lines and has an ultimate capacity of 150 lines. Illustrations are shown of front view of face equipment, top view of keyshelf, arrangement of apparatus on connecting rack, cord circuits of the double supervision type with and without repeating coils.

Each important piece of apparatus for this board is described in a similar manner to that in the telephone booklet.

The telephone buyer of today, the same as any other buyer, naturally desires to get full value for his money, and it will be to the advantage of every telephone man to read both of these booklets and know why the use of the best materials will result in longer service at minimum cost, producing in the long run, the cheapest equipment possible to buy.

The Kellogg Company will gladly send copies of these booklets upon request.

English Ask Private Ownership

Several London newspapers are conducting a campaign to bring about the separation of England's telephone service from post office department control. These papers cite the highly efficient telephone systems of the United States as an example of what might be accomplished in England. In one year one large American telephone company installed more new telephones than have been added to London's system in forty years, one of these papers declares.

A telephone is a prized possession in what relatively few London homes have them. A resident of the British capital cannot have a telephone simply by ordering it. Lack of equipment and personnel has put expansion of telephone service in arrears of requirements. A person holding a telephone contract and intending to leave the city usually advertises in a newspaper the fact and invites offers of premiums, as he has the privilege of subletting his contracts. Contracts have been transferred for premiums from $200 to $500.

Cables Underground at Last in England

The general scheme planned before the war of placing underground all the wires acquired by the National Telephone Company in 1912 has, according to the *London Times*, been put in hand, starting with Leeds (England) district, plans also have been made and contracts placed for many other big centers. The greater part of the Leeds cable will be laid underground before the end of this year, and it is estimated that the whole program will take between two and three years to complete. The first important underground cable to be commenced was the one between Leeds and London, but will not be the first to be completed.

Public Utility Commission News

Reports Concerning the Activities of State Authorities in the Telephone Field

National

A resolution which, in effect, urges the regulation of the telephone companies of the United States doing primarily an intrastate business by the state commissions and the regulation of interstate business by the interstate commerce commission, was adopted by the National Association of Railway and Utilities Commissioners, in convention at the Claypool hotel in Indianapolis last month.

The resolution follows:

"Resolved by this association in convention, That the best interest of all persons concerned will be best preserved by the enactment of laws embodying the following principles: First, that the regulatory powers of the states as now existing be vigilantly safeguarded. Second, that the powers of the interstate commerce commission be extended to include comprehensive regulation of rules and rates governing interstate commerce. The interstate commerce commission should not be burdened with security issues and consolidations affecting the great mass of companies in this country who are carrying on primarily a local business. Third, that the laws governing the regulation of the telephone companies should be considered separate and apart from the laws governing the regulation of railroad companies."

The association voted unanimously to hold the national convention in 1920 in Washington, D. C. Invitations for the next meeting were received from St. Louis, Washington, D. C., Detroit, Louisville, Asbury Park, N. J., Cleveland, Harrisburg, Seattle, and San Francisco, but the convention voted to accept the report of the committee on time and place, presented by John W. McCardle, of the Indiana commission.

The association held two conferences, one discussing commission practices in rate matters and the other discussing reports of special committees. On the program for the day was also a round table discussion of electric street railways and interurbans. The two conferences were postponed from the previous afternoon. Some of the commissioners indicated a desire for further discussion on the rate question, and final adjournment was postponed until after a night session. During the session the consideration of resolutions was on the program.

The knotty problems of finding the most equitable way of arriving at the valuations of public utilities as a basis for rate making was discussed from several angles at one conference. The fact that at present $1 is not worth much more than 50 cents in comparison with what money would purchase before the war is a thing that enters into the problem, for some utilities desire this fact to be taken into consideration in the process of valuation. However, it was pointed out that the utilities would not be willing to double the interest on their bonds on the theory that $1 is now worth only 50 cents. It was agreed that when it is possible it is desirable to estimate the valuations from the amounts of original costs.

During the round-table discussion on rates E. I. Lewis, of the Indiana commission, said there is a growing tendency of the Indiana commission in fixing rates to consider money actually invested rather than reproduction cost. Companies insisting on consideration of reproduction costs, he said, usually, when asked if they are willing to accept the reproduction costs in five years, show unwillingness to do so. Paul P. Haynes, also of the Indiana commission, called attention to the fallacy of the reproduction cost theory in fixing rates.

Georgia

Atlanta is in line for an automatic telephone exchange, according to the report of the Southern Bell Telephone Company on proposed improvements made to the Railroad Commission. Just when the installation of this mechanical equipment can be expected depends, it is stated, upon factory conditions and development, but the probability is that the first equipment will be completed by the end of 1921 or early in 1922.

Another feature of the report is that the Southern Bell will spend $9,000,000 for plant extension in Georgia during the next three years. Included in this amount will be the cost of a new central office in Savannah, besides many improvements in Atlanta and elsewhere.

To attract and make comfortable the operators the company announced that it had leased a centrally located apartment house in Atlanta for two years at a rental of $6,300, and have spent $30,000 on improvements there in order to furnish living places for 120 operators. The company will give them reasonable room and board at a loss of $17 per person, it is estimated.

Every effort is being made to have 100 operators apply every month for the next fifteen months in order that the supply may equal the demand for workers. A bonus of $5 is given every employee who brings in a new operator. An entire floor of the Ivy exchange has been turned over to the training school.

With the exception of Atlanta the service at all the principal exchanges, Atlanta, Savannah, Augusta, Macon and Columbus, was reported to have reached the grade of "good," with Savannah and Augusta on the "excellent" list.

Illinois

From a year and a half to two years will be required by the Chicago Telephone Company to make an inventory of its holdings in Chicago and suburbs, according to Samuel Rhodes, chief engineer for the company, who testified before the public utilities commission.

Mr. Rhodes' testimony had to do chiefly with improvements made by the company in its toll service. While it was almost impossible twenty years ago, he said, to carry on a conversation between Chicago and New York, this now can be done with ease, and so highly have transmitters been developed that the only limitation to the distance the human voice may be carried is the length of the wires.

He said $4.25 was the cost of each telephone instrument, including the transmitter, receiver and box. Among the superior features of the company's equipment were twelve telephone "repeaters" which are used for increasing the sound in toll calls.

During his testimony Mr. Rhodes introduced an appraisal of the company's holdings made by himself. The statement, which excluded all real estate, set $80,000,000 as the value at the present time.

Development of the service ren-

dered by the Chicago Telephone Company was outlined by W. D. Bangs, counsel for the company. Mr. Bangs presented data to show improvements in service. In 1883, it was shown, the company supplied 685,000 persons with 2,971 telephones, one to 233 persons. Now the 2,760,000 residents of Chicago have 504,428 telephones, one for every eighteen persons.

The Chicago Telephone Company lost $1,875,000 during the time that its lines were under government control, President B. E. Sunny told the commission.

The money, he said, was advanced by the company and has never been returned by the government.

With reference to the expenses of the company, to meet which it is asking an increase in rates, Mr. Sunny said they would be between $9,000,000 and $10,000,000 for the year 1920, as against not quite $6,000,000 for the year 1918.

The increase, he said, would be caused by replacing equipment which had been worn out and which could not be duplicated during the war.

The state utilities commission entered an order authorizing the Chicago Telephone Company to purchase the telephone properties of the Independent Telephone and Telegraph Company in a number of cities in northern Illinois.

The Central Union Telephone Company has taken over the properties of the Independent company at Springfield, Peoria and Sterling. The commission suspended until March 20, 1920, proposed advances in toll service rates filed by the Central Union.

The Illinois Public Utilities Commission has rendered an important decision in the case involving a petition for advanced electric rates of the Monmouth Public Service Company. In its order the commission found that the company was being operated "in an efficient and able manner with a view of securing as low costs of production as possible" and that "the commission is fully in accord with the theory that operation of this nature should be rewarded."

"It would obviously be improper," says the ruling, "to base rates for utilities service upon a hard and fast rule of the actual expenses of operation and fixed rates of return without regard to the efficiency displayed in the conduct of the business. Such procedure would offer no incentive for improvement and no reward for accomplishment. The public has the right to expect efficiency of operation of utilities engaged in public service and has the right to share in its benefits, but accomplishment merits a tangible and genuine compensation for its achievements."

In making up his exhibit supporting the petition of the Central Union Telephone Company to increase its rates in Decatur, the auditor of that company calls attention of the state board of public utilities to the merger of the Home Telephone Company with the Central Union Telephone Company, and sets up that the price paid for the Home Telephone Company's property taken over was $16,000 more than it was worth.

That about $125,000 worth of the property could not be used and was disposed of at a loss.

That the total loss on the merger was $68,000. Under that claim the company is allowed to charge off $6,313.37 annually as an expense until the loss in this particular is made up. At the time the merger was effected the franchise of the company had about eighteen years yet to run.

The company claims that for the year 1918 the total net income, before deducting a depreciation charge was $36,260.21. The company claims an annual depreciation charge of $54,986.14, which makes the loss for 1918 $18,725.93.

It is claimed that the increased telephone rates asked for would yield additional income to the extent of $59,005, but the claim is made that during the year 1919 their estimated increase in operating expense is $64,650, making a deficit for 1919 of $24,370.93.

The increases in operating expenses are set forth in four items:

Wages	$44,987
Other increases in expenses	12,456
Amortization of franchise	893
Amortization of intangible capital (which is money invested in purchase of Home Telephone Company and lost in taking over the physical property and sale of that part that could not be used)	6,313

When the merger was agreed to the company agreed to install a police call system for the city of Decatur. It is claimed this cost the company about $16,000. That is also charged in the expense account, and is a loss. While of great convenience to the police department, it is of no value to the telephone company.

The schedule of rates that the company asks for is as follows:

Single line business phone	$4.50 mo.
Two-party line	3.75 mo.
Extension, same as now	1.00 mo.
Single residence line	2.50 mo.
Two-party residence line	2.00 mo.
Extensions	.50 mo.

The next hearing is set for December 1.

An order has been approved and consent given by the Public Utilities Commission for the purchase by the Chesterfield Telephone Company and sale by the Medora Telephone Company of all the latter's property located in Medora and certain toll lines connected therewith.

The Chesterfield Telephone Company is authorized to execute and deliver its first mortgage or deed of trust dated October 1, 1919, to W. J. Chapman of Jerseyville, trustee, covering all its property, whether now owned or hereafter to be acquired to secure an issue of first mortgage six percent gold bonds to an amount not exceeding $12,000.

W. J. Finch, manager of the Chesterfield Telephone Company, as well as the Medora Telephone Company, said that the transfer of the Medora property to the Chesterfield company would in no way affect local operations or service.

The Medora company was purchased a number of months ago by the owners of the Chesterfield company. It has been operated, however, as a separate organization. The latest move is merely for the purpose of merging both companies into one.

The Stephenson County Telephone Company was authorized by the commission to increase its rates in Freeport as follows: Individual unlimited business line from $33 to $45 per year; two-party unlimited business line from $30 to $39 a year; individual unlimited residence line from $27 to $30 a year; rural unlimited residence line from $18 to $21 a year.

No change has been made in the rate of the four-party residence line. The company did not ask a higher rate from four-party line patrons.

Authority to purchase existing telephone companies and properties in New Holland and Elkhart and to buy out the Central Illinois Telephone and Telegraph Company in Lincoln was given the Lincoln Telephone Company by the state public utilities commission. This company will buy out both the Elkhart Independent Telephone Company and the New Holland Telephone Company and operate exchanges in their places.

Indiana

Recommendation that a uniform charge of $3.50 be made in Indiana for installing a telephone, is contained in a report which has been filed with the Indiana public service commission by a special committee appointed several weeks ago by that body to investigate the advisability of continuing a schedule of extra fees for service connections. The commission announces that the report of the committee is not final and that each recommendation will be carefully considered before any orders are issued.

On the committee were: H. O. Garman, chief engineer for the commission; Robert E. Tracey, of the government research bureau, Indianapolis Chamber of Commerce, for the Indiana Municipal League, and S. B. Ridge, of Chicago, general plant engineer for the Central Union Telephone Company.

The committee suggests that a charge of $3.50 be made for installing a telephone; a charge of $1.50 for the establishment of service when the telephone instrument is already installed; $3 for moving instrument from one place to another on the same premises; $3 for change in type of telephone set; $1.50 for change in name where service is already established; no charge for change of telephone number; and "when service is temporarily discontinued by the company on account of nonpayment of bill the above service connection charges shall not apply."

The cost of moving telephones is one feature of the report which is considered when rates are fixed.

The committee recommended that the charges be made mandatory for telephone Classes A and B, which include all principal companies, and that they be made optional for all companies of 500 or less instruments. The committee recommended that the charges not apply to a resumption of connection after discontinuance because of nonpayment of bill.

The committee found that one year and nine months is the average length of life of a telephone connection in Indianapolis where there are 5,700 telephone subscribers. The committee found that in seven years of experience a net increase of one telephone is obtained to each four put in. After pointing out these observations the committee said:

"It is very apparent that in the telephone business there is a very rapid turnover of telephone stations and in Indianapolis there was a complete turnover in all stations in 2.5 years, or in other words, in 2.5 years the telephone company connected and disconnected as many telephones as were in actual service."

William A. Barnhart, president of the Indiana Telephone Association, and Frank O. Cuppy, secretary of the association, arranged with E. I. Lewis, chairman of the public service commission, for a conference October 27, on the situation confronting Hoosier Independent telephone companies that put Burleson rates into effect last summer. The rates automatically go out of force December 1. Members of the executive committee of the association attended the conference.

More than a dozen of the Independents put Burleson rates into effect and as yet the commission has made no announcement of dates on which it will hear the companies. The commission has fixed dates for the Central Union Telephone Company hearings. The Independents are uneasy for fear the commission will not get their rates adjusted before the present ones go out of effect.

Chairman Lewis, however, believes that the Independents need have no fear and that the situation will be cleared up before December 1.

The quality of the service rendered by the Home Telephone and Telegraph Company of Fort Wayne was taken up in the public service commission's hearing on the petitions of the company and the city of Fort Wayne for increase and decrease, respectively, of the rates now in effect.

Paul H. Haynes, the commissioner conducting the hearing, interrogated Mr. Bohn on several points and also took occasion to explain a policy of the commission which holds that rates and service cannot be disassociated and that a company which is not giving a full measure of service cannot expect the rate commanded by a company providing the best of service. If dividends or service must be sacrificed the dividends must go, Mr. Haynes declared. In this connection Mr. Haynes said that he wished to congratulate the Home company on the spirit shown by Mr. Bohn regarding co-operation with the public and on his desire to give the best possible service.

A ruling of the commission authorizes H. R. Moltz, H. M. Smith and I. D. Dailey to purchase the Monroe Telephone System from Dr. M. F. Parrish. The transfer was made October 1 and the consideration as announced by the commission was $16,000 in cash. The system includes 400 subscribers, of which 75 are on single lines, has 69 miles of pole line and a switchboard capacity of 150.

Kansas

In support of their contention that the Burleson telephone rates, even if higher than were asked a year or two ago by the telephone companies themselves, still are reasonable for the present era of high prices, the companies are deluging the Kansas Public Utilities Commission with figures on increased costs and wage scales. Incidentally they are making a strong case.

The United Telephone Company, for instance, which operates twenty-four stations through central Kansas, including Abilene, Salina, Lindsborg and Herington, shows a traffic pay roll increase of 59.1 per cent from April to August this year. Traffic pay roll takes in switchboard operation. This company told the commission it was operating 17,536 main line stations. In April the traffic pay roll was 50.7 cents per station per month. In August it was 80.7 cents, an increase of 30 cents per telephone. Its April traffic pay roll was $8,903.73; August $14,166.75. During the same period the plant pay roll jumped from $4,621.70 to $6,985.80. In April the combined traffic and pay roll expenses for each of the 17,536 stations (telephones) was 77.1 cents per month; in August the testimony showed it was $1,206. This increase, the company witnesses declared, ate up the increased revenues, $8,000 a month coming to the companies on its system from the Burleson rates.

Questioning before the commission brought out that the commission is trying to determine how much weight should be given the probability that the present high prices are more or less temporary.

Kentucky

The State Railroad Commission permitted the Central Home Telephone & Telegraph Company, of Louisville, and its subsidiary, the Independent Long Distance Telephone & Telegraph Company, to continue in force the rates authorized while the lines were under government control. The commission has not the authority to establish rates and will hear any complaints that might be made regarding the schedule filed by the telephone companies.

Michigan

Increase in rentals were granted to the Farmers Telephone Company of Dundee and Azalia, by the Michigan Utilities Commission at a public hearing held at the office in Lansing. New rates for this Monroe County company are: One-party business telephone, $27 a year; two-party business, $24; one-party residence, $18; party service not more than four to a line, $15; farm line telephone, $18; extension telephone $6.

Missouri

The commission granted increased rates to the Kinloch Telephone Company in St. Louis and suburban cities, to become effective October 1 and remain in force for a period of thirteen months. The suburban cities affected are Clayton, Kirkwood, Ferguson, Florissant, Webster Groves, Valley Park and St. Charles. In the opinion, which was written by Commissioner Simpson, the new rates are called an emergency. According to the opinion, the company earned but $1,439 last July over operating expenses, taxes, etc., and during this period there was a saving of three days of wages due to a strike, otherwise the company would not have earned anything.

Commissioner Simpson says that the increased rates will not earn over $200,000 a year above the existing rates, and from this excess earnings will have to be paid $100,000 in increased wages and about $25,000 in increased taxes. These additional expenses, he says, will deplete the net income so as to allow less than 3 per cent dividends on the outstanding capital of $2,790,000, or a return of about 3 per cent on the book cost of the system. The new rates, effective October 1, are as follows:

St. Louis—Independent business lines, increased from $72 to $84 a year; two-party business lines, from $60 to $69; residences, two-party lines, from $36 to $39; four-party lines, from $24 to $30; physicians, independent line, $60 to $72; two-party lines, physicians, $50 to $59. Extra listing, nonsubscribers, from $8 to $10; regular subscribers, from $6 to $8.

The rates at Clayton, Valley Park and St. Charles are the same. They follow: Business telephones, from $30 to $36 a year; residences, independent lines, from $18 to $21; two-party lines, from $15 to $18.

The Ferguson, Florissant, Webster Groves and Kirkwood rates are the same, as follows: Business, independent lines, from $32 to $38 a year; two-party business lines, from $28 to $34; residences, independent, from $32 to $38; two-party lines, from $18 to $21; four-party lines, from $16 to $19.

H. Linton Reber, president, and William R. Orthwein, counsel for the Kinloch company, stated the company's reasons for asking for an emergency rate increase.

They said that when the government took over the company's properties July 31, 1918, it agreed that $10,000,000 was a fair valution of the property on which the company was entitled to earn 5 per cent. On this basis the government assumed payment of all interest and taxes and agreed to pay the company $266,000 a year as the equivalent of its average net earnings when operated under private control.

When the government turned back the property August 1 this guarantee of $266,000 a year was withdrawn, they said, and the company faced the prospect of decreased earnings with larger expenses, some of which, especially the wage increase of $230,000 a year had been instituted by the government during its period of control. Reber told Commissioner Simpson that in July of this year, the last month of government operation, the company's revenue fell $20,000 short of the monthly revenue needed to assure the annual earnings guaranteed by the government. With the withdrawal of this guarantee, he said, there was a prospect of a still further decrease in the earnings and emergency relief was asked for, pending a formal application to the commission for an official valuation of the properties. Reber said he believed this appraisal would be found to justify even a further increase in rates.

Officials of the Southwestern Bell Telephone Company are considering plans for refinancing the entire system so that improvements and extensions held up by the war may now be made.

E. D. Nims, president of the company, visited the State Public Service Commission in Jefferson City to discuss the matter. He said that so far the company has not decided on what amount it will require or how it will refinance itself, by a straight loan or by a bond issue. He said that it had been planned to spend $8,000,000 to $10,000,000 on improvements this year, but he wanted considerably more than that amount, how much he could not say.

While at Jefferson City Nims told the commission that the plans of the company will be submitted in a short time. He did not go into details, but said the plans would speak for themselves. He said that for the last four years the company has been compelled to forego many needed improvements and extensions of service because of war conditions. He declared that in almost every city of any consequence the business of the company has outgrown its facilities. The refinancing scheme will deal with all these conditions and provide ways of meeting public demands.

Nebraska

The Platte Valley Telephone Company with headquarters at Scottsbluff, has secured permission from the railway commission to increase its rates. The company operates seven exchanges and the new schedule of rates is as follows:

Bayard—Individual business, $3.25; individual residence, $2.00; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

Gering—Individual business, $3.75; individual residence, $2.25; farm business, $2.50; switching, 50 cents.

Melbeta—Individual business, $3.25; individual residence, $2.00; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

Minatare — Individual business, $3.25; individual residence, $2.00; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

Mitchell—Individual business, $3.25; individual residence, $2.00; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

Morrill—Individual business, $3.25; individual residence, $2.00; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

Scottsbluff — Individual business, $3.75; individual residence, $2.25; four-party residence, $1.75; farm business, $2.50; farm residence, $2.00; switching, 50 cents.

The increases are $1.00 a month for business telephones and 50 cents for residence service on the exchange at Gering and Scottsbluff and 50 cents on business and 25 cents on residence at the five other exchanges. A discount of 25 per cent is allowed on the business and residence rates if paid on or before the 10th of the current month and the same monthly discount is available for rural service if paid quarterly in advance.

The system in Nebraska is metallic with magneto central office equipment. It is proposed to establish at Melbeta in automatic plant. This is partly an

experiment and if found satisfactory the automatic equipment may be adopted for the other exchanges. Because of this installation the company asked for 25 cents a month more at Melbeta on each class of service than the commission would allow.

The commission suggests the substitution of central energy plan at the two principal towns, Scottsbluff and Gering, the size of the towns and the character of the country justifying this.

The state railway commission has given the Wynot Telephone Company an increase of rates for a period of six months. The company alleged its property is worth $20,000, but the commission eliminated a residence used partly for telephone purposes, and finds the value to be $6,071. The new rates are: Business, $2.50; residence, $1.50; farm, where the company owns instruments, $1.50; farm, where subscribers own instruments, $1.25; switching, 50 cents.

It was found that the owner of the company keeps the exchange in his residence, which is a fairly valuable property. The residence was listed as company property, on which the company sought to pay dividends. However, the commission has struck the house and lot out of the company's holdings, allowing a nominal sum for rent to be charged against maintenance.

The Crownover Telephone Company, of Sargent, has been ordered by the state railway commission to restore the telephone on Patrick Sullivan's farm that it removed because he would not pay a 10 cent toll charge the company sought to collect. It must do this without any expense to Sullivan and it must forego the collection of the 10 cent charge.

The commission says that it is not in favor of telephone mooching, but that in this case the company made a far-fetched interpretation of the rule relating to calls by or for non-subscribers. Sullivan's son telephoned to town for a veterinary surgeon, and at the same time told the doctor that a neighbor also desired his services.

The company said this was a misuse of the telephone, and when Sullivan refused to pay the 10 cents took out his telephone. The commission says that where the information conveyed was a mere incident to the conversation and not a deliberate attempt to beat the company out of a call, the charge cannot be enforced.

The application of the Farmers and Merchants Telephone Company of Alma for leave to issue $17,949 of stock to stockholders in return for services performed and for the construction work has been passed upon by the railway commission. The company is permitted to issue 100 stock to the amount of 10 per cent of the stock now held, dating from January 1, 1919. In lieu of $12,715 of the amount to be issued, plus 7 per cent from January 1, 1917, less net income derived from a building constructed, from January 1, 1917, to January 1, 1919, the company may convey the lots and building erected by the company in 1914, to the persons comprising the stockholders in common, or to a corporation to be formed by the stockholders. The remainder of the $16,012.50 may be issued as a stock dividend. The company is to refund all its obligations over and above $5,000 in bonds or bills payable at not to exceed 8 per cent.

An increase of rates for the Farmers' Mutual Telephone of Avoca has been granted by the railway commission. The company does only a switching business and has been charging 50 cents a month to subscribers in town and 25 cents a month to subscribers in the country. It desires to charge 25 cents additional to both classes. This request is granted. The company had a net profit of only $16.82 in 1918. With increased expenses already arranged for, not allowing anything for an increase in the cost of material and certain classes of labor, the estimated deficit is more than $600 a year. The new rates and toll charges an additional revenue of $2,024.

New York

Telephone calls between any two of the five boroughs of Greater New York have dropped to five cents, and a flat reduction of 8 per cent in rates also went into effect as the result of the order of the Public Service Commission.

Bills of the New York Telephone Company in advance for October reflect the decrease. For example, a subscriber now paying $40 yearly for 800 calls hereafter will pay but $36.80, while a company using 3 600 calls will pay $132.48 instead of $144. It has been estimated that the 8 per cent reduction will mean a saving to subscribers yearly of $2,400,000, while the nickel interborough rate will keep between $500,000 and $1,000,000 out of the slot machines.

The new rate will be in force for one year. At the end of this time the Public Service Commission will reopen the case and possibly make further reduction or increase.

Ohio

A new rate of approximately 10 per cent increase was approved by the state utilities commission at Columbus. This rate schedule was given the Ohio State Telephone Company for Dayton and the Miamisburg district.

The increase is effective "except where charges for installation of telephone service, in violation of the order is being made," the dispatch stated. The commission, in a written order, refused to grant a rehearing on its recent action in which installation charges were abolished.

Virginia

The Corporation Commission of the state of Virginia has issued a statement signed by Alexander Forward, commissioner, relative to the status of rates to be charged by the telephone companies of the state. The statement follows:

"In order that no confusion or misunderstanding may exist with reference to the status of rates to be charged for service of telephone companies in Virginia on and after December 1, 1919, the State Corporation Commission issues this statement to make the situation clear.

"The act of Congress approved July 11, 1919, providing for the return of the telephone, telegraph, marine cable and radio systems to their owners, stipulates that 'the existing toll and exchange telephone rates as established or approved by the Postmaster-General on or prior to June 6, 1919, shall continue in force for a period not to exceed four months after this act takes effect, unless sooner modified or changed by the public authorities—state, municipal or otherwise—having control or jurisdiction of tolls, charges and rates, or by contract or by voluntary reduction.'

"In accordance with the terms of the act of Congress aforesaid all rates, tolls and charges in existence at the time the wire lines were taken over by the United States government will be the rates, tolls and charges in effect in Virginia from and after 12 o'clock midnight, November 30, 1919,

the State, municipal or other authorities having control or jurisdiction of tolls, charges and rates, or by contract or by voluntary reduction."

Wisconsin

An increase in the rates of the Cottage Grove Telephone Company was authorized by the Wisconsin railroad commission. Business telephone rates will be $7.50 per quarter and all other rates $6. A non-subscriber charge of five cents payable to the subscriber, where the non-subscriber is not a member of the household is authorized.

The Hammond Telephone Company is authorized to charge $1.50 per month for business telephones and $1.25 for residence telephones.

The Wonewoc Telephone Company is authorized to charge $24 per year for business main line service $18 per year for four party service and $7.20 per year for extensions. Resident main line service is $18 per year; rural service is $15 per year.

The commission authorized an increase of rates of the Pewaukee-Sussex Telephone Company. The new rates are $6 for individual lines per quarter; $5.25 for two-party lines, and $4.50 for four-party lines. The summer rate for five months or less, per season, $12.

The commission authorized the Leeds Farmers' Telephone Company to charge a gross rate of $4.15 per quarter; 75 cents of which will be discounted if bills are paid during the first month of the quarter.

It dismissed the complaint of the St. Croix Farmers' Mutual Telephone Company alleging that a competing line had been built in the towns of Blaine and Swiss in Burnett county without serving notice on the complaining company.

Increases of telephone rates and readjustment of schedules were authorized by the commission for the Columbia County Telephone Company and the La Crosse Interurban Telephone Company. The Columbia County Telephone Company, is authorized to charge $1.90 for business on party service, $1.65 for business two party service and $1.35 for residence two or four party service. The charge for rural service is $4.15 per quarter.

The La Crosse Interurban Telephone Company is authorized to charge $27 for business one party service, $24 for residence one party service, and $21 for two party service and $18 for four party service. The charge for rural service is $21 per year.

The commission has granted increase in rates to the Coon Valley Farmers Telephone Company, authorized an increase of $1 per quarter to all telephones. The Western Wisconsin Telephone Company, with ten exchanges operating in and around Calumet, Sheboygan, Manitowoc and Fond du Lac counties is authorized to increase rates of $1 for rural and residential service and $1.25 for business service. The Bayfield Telephone Company is authorized to increase rates from $1 to $1.25 a month. The Hager City Telephone Company, is allowed to increase rates from $9 to $12 a year with extra charge for all calls outside regular hours.

The Nelsonville Telephone Company in Portage county, handles calls between the Amherst Telephone Company and the Scandinavia Telephone Company and the Elderon Telephone Company without receiving any compensation for the exchange service and in a petition filed with the Rail-Company and terminating with the Scandinavia Telephone Company and vice versa a charge of five cents be made for the exchange service at Nelsonville, and upon toll messages originating with the Amherst Telephone Company or the Scandinavia Company and vice versa, a charge of 10 cents be made.

A public hearing was held upon the petition, in Madison with the following appearances: George C. Larson, president, Nelsonville exchange; O. L. Christenson, secretary and treasurer; R. E. Curran, manager, Elderon company. The commission's findings are to the effect that the request of the petitioning company is fair and reasonable.

Under a decision of the commission, the Bell Telephone Company is permitted to purchase the Bayfield County Telephone Company, the Ashland Home Telephone Company, and the North Wisconsin Toll Line Company, operating between Washburn and Ashland and adjacent local territory. For 16 years these Independent companies have been operating in this territory, in opposition to the Bell, but with the recent purchase it leaves the Bell people in exclusive control of the telephone business in north Wisconsin. A rate increase also was granted.

The commission, authorizing an increase in the rates of the Western Wisconsin Telephone Company, which owns and operates 10 exchanges and a toll system in Calumet, Sheboygan, Manitowoc and Fond du Lac counties, states that the data contained in the published reports of the company might be used to justify the proposed increases, but that the reasonableness of the schedules offered by the company is so evident in view of the general experience of other telephone utilities that the increase might be authorized without any detailed comparison of the operating costs.

The company has recently requested the commission to consider an exchange radius charge to be applied to rural subscribers, residing beyond certain distances from the central office. Though some of the circuits are from eight to ten miles long, it appears that many of them have more subscribers per line than is provided by the commission's standards of service. The records show that the company has repeatedly had its attention called to the crowded condition of its rural circuits, but as vet has taken no steps to improve this condition. These conditions must be improved, the commission holds, regardless of whether it increases operating costs or not. The commission's order authorized the following schedule of rates:

Johnsburg and vicinity, business telephones, per month, $1.25. Residence or rural telephones, per month, $1.00.

Mount Calvary, business telephones, per month, $1.25. Residence telephones, per month, $1.00. Switching service, per telephone, per month, $0.25.

Plymouth, residence or rural telephones, per month, $1.25.

Pennsylvania

The chairman of the Pennsylvania Public Service Commission in a recent case rules that telephone patrons have no right to hold a line for long talks running from fifteen minutes to a half hour, and that a subscriber might be cut off for such misuse of his line.

Minnesota

An attempt to bring about a complete readjustment of telephone rates —local and long distance—in Minnesota will shortly be undertaken by the state railroad and warehouse commission, says Commissioner Putnam. The question will be brought up without formal complaints from tele-

phone users or municipalities on an order directing the companies to show cause why they should not restore their prewar rate schedules.

Failure of the large telephone companies to prevail on the State Railroad and Warehouse Commission to ignore valuations of its own engineers and accept those of the companies as a basis for making rates was revealed.

Valuations made by engineers of the commission are lower than those made by engineers of the companies, it was stated at the offices of the commission. This was the first indication of the commission's position on valuation of the telephone properties, on which hinges the whole question of rates and charges, and was the first intimation of the result of the commission's valuation started more than two years ago.

Commissioner Fred W. Putnam, in charge of telephone matters for the commission, indicated that the commission will issue orders to show which will throw the whole question of rates before the commission for adjustment through hearings to determine the fairness of rates.

Not only the rates, but all rules and regulations put in by the companies under Federal control must be justified before the commission. Under the law turning back the lines to the companies, the government provided that these rules and rates should remain in force until December 1.

Refusal of the commission to disregard the valuations made by its own engineering staff after two years of work and accept without question those made by the company may prolong the hearings, it was stated, but lower rates are more liable to result.

D. F. Jurgensen, chief engineer to the commission, has presented valuation reports with supporting evidence as a basis for rate making, which, it was declared, would stand in any court.

One preliminary test on pole line construction showed an average allowance of more than 30 per cent more by the state than by the company engineers, but state valuations were declared to be much lower as a whole.

Earlier determination of the fairness of telephone rates may be expected now that the commission has evidenced that it will stand by the figures in its valuation, it was declared. It is expected that hearings will begin in November.

In the first proceedings the Tri-State and Northwestern Telephone Companies will be cited to appear and defend present exchange and toll rates and service charges. The inquiry will be extended to the "report" charge, charges for different classifications of long distance service, installation charges and the reasonableness of local rates.

The valuation made by the state engineers covers only that of the toll service, the legislature refusing to provide sufficient money to make a complete valuation of the telephone properties. The engineers of the company have made a valuation of all the exchange properties in addition to that of the toll lines.

In making its valuations, however, the commission necessarily had to obtain the valuations of exchange properties to some extent. Engineers of the commission have arrived at certain units of valuation, by which they may check the valuation of the company on all phases of the properties in a short time. This will be done.

Only in details where incontrovertible proof is presented will the commission vary from its valuations, it was stated.

The Freeport Telephone Company permitted to place in effect, as of November 1, 1919, the following schedule of rates for local and rural telephone service at Freeport, Minnesota:

Individual Line Business, $2.50 per month gross.

Two-party Line Business, $2.25 per month gross.

Individual Line Residence, $1.75 per month gross.

Two-party Line Residence, $1.50 per month gross.

Rural Multi-party (company owned), $1.75 per month gross.

A discount of 25 cents will be allowed if bill is paid on or before the 15th day of the month in which the service is rendered.

The application of the Bellingham Telephone Company for authority to surrender its indeterminate permit for the Nassau exchange, and be permitted further to remove its wire plant, station equipment and central office equipment from the village of Nassau and immediate vicinity, will be heard at the City Hall, in the village of Nassau, at 7:30 p. m., on the 10th day of November.

Better Long Distance Service Everywhere

All over the United States telephone service is getting better. Employes who served with the American Expeditionary Forces, have been returning to their former positions. Material that was not available during the war has been gradually coming back on the market. Companies have been investing thousands of dollars in equipment and labor in an effort to restore the service to its former efficiency and even improved efficiency in the majority of cases. Increased rates have helped out financially and if adjusted properly will enable the companies to continue these improvements.

Every possible effort should be made to improve the local and long distance service at each exchange. The highest type of operators should be employed and they shocld be properly trained and supervised. The facilities for furnishing long distance service should be the very best to start with and should be kept in this condition at all times. Don't be the last exchange to get your service better than it is at any other place in the state.—ROY F. MAPES, Secretary, Michigan Independent Telephone and Traffic Association.

Earth Currents Disturb Communications

"Earth currents," usually noticeable in connection with a display of Aurora Borealis, interrupted telegraph and telephone communication all over the country the afternoon and evening of October 1.

Wires were tied up for considerable periods by these invading currents and the telegraph and telephone companies could do nothing but wait until the manifestations had passed.

Press associations and newspapers were the principal sufferers by the interruptions during the evening hours. Wire communications of the bankers and brokers in the Wall street district were hard hit in the afternoon.

Improvements for Dallas Include Automatic

Declaring telephone service will be improved on February 1, that improvements to cost $2,044,900 are under way, of which cost $344,400 is labor, and that the service is as good as can be given under present conditions, J. E. Farnsworth appealed to the city commission of Dallas, Texas, to make a thorough investigation of conditions and to tell its findings to the people of Dallas.

The city commission is considering an ordinance permitting the Dallas Telephone Company to install automatic service in the city altogether.

New Express Packing Rules in December

New express packing rules, similar to those required for freight movement on the railroads, will go into effect on December 10, and express shippers are requested to prepare themselves for the new standards. The new packing requirements, which were recently approved by the United States Railroad Administration, were formulated to provide additional safeguards for merchandise sent by express. Heretofore, shippers have been using all sorts of containers for express packages, but the new rules are expected to make the regulations uniform and thus provide business concerns with an even more reliable and speedy service.

Preparations are being made at local offices of the American Railway Express Company, which is the agent of the government in handling the express business of the entire country, to put the new rules into effect on December 10, and to require a strict adherence to them thereafter. The express officials expect that in this way shippers will be induced to pay greater attention to their packing methods and to turn their business over to the carrier substantially packed and clearly marked, so that, with reasonable care on the part of expressmen ,all traffic can be handled rapidly and with fewer chances of loss or damage in transit.

The rules, recently promulgated, will not permit the use of paper wrapping for packages over 25 pounds, nor ordinary paper boxes, wrapped or unwrapped, when the weight of the package is over that limit. For shipments over 25 pounds, wooden containers, or containers of fibreboard, pulpboard or corrugated strawboard material are required. The cartons must be made of materials of specified "test strengths," similar to those required for the freight service, and the containers must bear the stamp of the manufacturers certifying that the material used is of strength required for the weight of the shipment carried in it, as called for in the rules.

The express regulations, though modeled on those for freight movement, permit a wider latitude in the size of the carton used, and carry a certain number of exceptions. Shippers who wish to acquaint themselves with the new express regulations are requested to study Supplement No. 5 to Express Classification No. 26, in which these rules are embodied, and copies of which may be secured at any express office. It is calculated that the time remaining before December 10 will be sufficient to enable express shippers to adjust themselves to the new packing standards.

Bell Spends Money in Dayton

As soon as plans can be completed and contracts let, the Bell Telephone Company will erect a four or six story concrete and steel building on a lot at 117 West Second Street in Dayton, O., in which will be housed all of the company's local activities, including the traffic and commercial departments, with an additional storehouse for the plant department.

The real estate was purchased during 1913 at a price of $48,000, when the Bell company saw the need of increasing its facilities within a few years because of the constantly increasing demands being made upon its service in Dayton. The coming of the war, however delayed the building plans until this time.

Manager H. E. Allen said that the building will be modern in every respect and will typify the most modern improvements and equipment used in the appointment of telephone exchange construction. It is the hope of the company to move into the new building during the spring or early summer. Another big improvement will be the installation of new inside, outside, underground and cable equipment.

The Bell company has received several car loads of cable which will be used in the plans to increase the facilities in Oakwood. The improvement will start at Main street and extend to South street by way of Warren and Brown Streets. Cables will soon be completed to the new Dayton View exchange at Richmond Street and Deleware Avenue which has been completed for some time but left unequipped because of the inability to secure apparatus due to the war.

Operators Continue Service Through Omaha Riots

During the excitement, rioting and destruction which ran rampant in Omaha last month, there was one body of girls, unheralded, unaplauded, and overworked, who remained at their tasks with never a break, serving the public in a period of stress, one of the worst in the history of Omaha.

The operators employed by the Nebraska Telephone Company, sitting quietly at their boards, answering hundreds of emergency calls made by unthinking seekers after information, performed a service the value of which cannot be overestimated. Many of the girls were forced, by the unusual number of calls, to remain in their chairs for 14 or 18 hours. All of them were called back to overtime work the next day, still on the alert, subject to call at any moment.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

Personal Notes

I. E. Brown has been appointed manager of the Southern Bell Telephone Company at Valdosta, Ga. and R. G. Spearman was appointed to fill the vacancy at Palatka, Fla.

B. J. King has been appointed manager of Bennettsville, S. C., group of exchanges of the Southern Bell Telephone Company, and R. F. Walker, former district manager at Darlington, N. C., has been transferred to Wilmington, N. C., as district manager.

E. T. Everett has resigned his position as local manager of the Southwestern Bell Telephone Company, at Hutchinson, Kansas, and expects to be connected with his brother, C. H. Everett, contractor.

After thirty years of continuous service the resignation of Union N. Bethell as president has been accepted with regret by the New York Telephone Company. The move, long contemplated by Mr. Bethell, was postponed on account of the country's entry into the war, and the consequent heavy demands made upon the company.

A. J. Weigle, who hails from Cedar Rapids, is local manager for the Iowa Telephone Company, at Hampton, succeeding C. A. Brown, who was recently transferred to Omaha.

L. L. Billups, formerly district manager of the Southern Bell Telephone Company at Paducah, Ky., has been transferred as district manager to Chattanooga, Tenn., succeeding Grey Gentry, resigned.

Miss Rose Denkinger, formerly chief operator at the office of the Nebraska Telephone Company at Humphrey, has been appointed as manager of that office, taking the place of Mrs. Mae Andrews who recently resigned that position.

W. A. Kelton has been transferred from the managership of the Southwestern Bell Telephone Company at Altus, Okla., to a similar position at Lawton, and E. E. Royse has arrived from Miami to take charge at Altus.

B. C. Jacobs, formerly district manager of the Southern Bell Telephone Company at Owensboro, Ky., has been transferred to Paducah, Ky., as district manager, succeeding L. L. Billups, transferred to Chattanooga, Tenn.

D. F. Wetzel, who for the past six months has been the local manager for the Nebraska Telephone Company at Schuyler, has resigned his position to engage in the automobile business in his home city of Norfolk.

Frank H. Bethell, first vice president of the New York Telephone Company and active head of the eastern group of telephone companies, covering the middle Atlantic states, will resign to become associated with a new oil corporation.

R. C. Wetzel, from Gorman, Texas, has been checked in as local manager of the Southwestern Telephone Company at Cameron, Texas, succeeding A. W. Luckett.

Frank B. O'Bleness, for nearly two years executive clerk of the board of administration and before that secretary to Warden Thomas, of the penitentiary, resigned recently to become publicity manager for Ohio division of the Central Union Telephone Company. Formerly he was in newspaper work in Columbus, for several years as manager of the local office of the Associated Press.

Announcement was made recently that W. E. Dougherty, manager of the Southwestern Bell Telephone Company, at Shawnee, Okla., had been transferred to Okmulgee as the manager of the Bell system there.

M. L. Saunders, district manager of the Michigan State Telephone Company for the past two and a half years, left recently for a much larger field, as district commercial superintendent in charge of the business of the company in the entire upper peninsula, with headquarters at Menominee.

D. Risen has taken over the management of the Auburn Telephone Exchange at Auburn, Ill.

F. H. Carlinere, of Binghamton, N. Y., has been secured as manager of the Oberlin Telephone Company at Oberlin, Ohio.

J. D. Andrews, lately of Mobile, Ala., who has been appointed district manager of the Atlanta office of the Southern Bell Telephone Company, has been district manager of the Mobile, Ala., district of the company, and succeeds S. B. Mathewson.

News From the Field

ARKANSAS

The new central energy telephone system of the DeQueen Telephone Company, at DeQueen, has arrived and is being installed.

The Southwestern Bell Telephone Company is installing a new plant and stringing wire over the entire city of Ashdown.

Ten citizens in the vicinity of Lone Oak who recently constructed a private telephone line to that city, have incorporated under the state laws and are now about to issue stock to each holder. A. G. Little and B. F. Gay were the movers in the enterprise.

The case of the Southwestern Bell Telephone Company, the rates, rules and regulations of which are undergoing investigation by the Arkansas Corporation Commission, was continued by the commission until November 3.

CALIFORNIA

Ned C. Steele, former employe of the Pacific States Telephone & Telegraph Company, has purchased from Daniel A. Hedger, the Live Oak Telephone system, including a building and lot, 40 miles of rural lines and equipment. Steele, who took possession on October 1, announces he will make several improvements which will give the patrons of the system better service.

Manager C. D. Cady, of the Woodland office of the Pacific Telephone & Telegraph Company, is co-operating with the residents of Esparto, Cadanasso and Guinda in the hope to bring about an extension of the farmers' line service which is now inadequate for the rural districts. Cady promises to bring the company's lines within a half mile of telephone centers in the farming belt. The people of Esparto through the farm center there have set out to obtain 60 new telephone connections in the hope to double the efficiency of the present service.

Farmers of the Gold Hill and Mt. Pleasant Farm Bureau districts, of Auburn, are planning to consolidate their forces to obtain a complete telephone system for the two districts. At present there are but few telephones among the farmers there. The connection will be made out of Lincoln, according to present plans. The matter received the indorsement of the Gold Hill bureau at a large meeting held recently. The following officers for the coming year were elected for the Gold Hill unit: Director, J. W. Daniels; vice-director, F. A. McMain; secretary, E. A. Stickney. The women's executive committee of the organization was announced as follows: Mrs. C. B. Hustis, Mrs. F. A. McMain and Mrs. C. D. Duncan.

FLORIDA

Glades Telephone Company. Principal place of business, Moore Haven. Capital stock, $15,000. Highest amount of indebtedness $15,000. General nature of business: To operate a telephone exchange in its entirety; to manufacture, purchase, or otherwise acquire goods, wares, merchandise and personal property of every class and description, erecting of wires, lines and poles, and to hold, own, sell or to otherwise dispose of, trade, deal in and deal with the same; to engage in the sale and manufacture of all parts, telephone parts and fixtures; to engage in the wholesale and retail business of all such parts and necessities connected with the manufacture, operation, service and efficiency of a telephone in its entirety, etc. Perpetual corporate existence. Officers and directors, E. C. Fish, president; G. P. Hardin, vice president; G. E. Worrell, secretary and treasurer.

GEORGIA

A petition for an increase of rates by the Statesboro Telephone Company at Atlanta was filed with the railroad commission recently.

The Murphysboro Telephone Company is spending $30,000 in Franklin county enlarging its field and extending its service there. An exchange is being established at Zeigler with trunk lines to Christopher and one line will be extended to West Frankfort. A long distance connection will be made

at Christopher, while arrangements are also under way to operate a line to Herrin from Zeigler. Benton is also to get two more trunk lines and a new switchboard, while a new station is being put in a West Frankfort exchange and improvements are being made also at Bush and Hurst in Williamson county.

ILLINOIS

The strike of telephone operators, inaugurated June 27 in Illinois, ended when operators returned to work in the Pana, Taylorville, Kincaid and Stonington exchanges. The company grants all the demands of the strikers. Arbitration of future disputes is provided for.

An application was made by the Macoupin County Telephone Company to the Illinois Public Utilities Commission for an order authorizing an increase of rates for rentals of telephones in Carlinville and vicinity. A new toll rate between Carlinville and Chesterfield is also asked.

George P. Ramsey, special examiner of the Illinois Public Utilities Commission, recently heard the petition of the Montgomery County Telephone & Telegraph Company, for authority to increase its rates in Hillsboro, Nokomis, Donnelson, Butler and Raymond.

Officials of the Vermilion County Telephone Company recently refunded money to quite a number of subscribers. The refund was made to comply with a ruling by the Illinois state public utilities commission that increased rates as announced by the company some time ago are not effective at this time. The amount refunded for one month on a two-party line amounted to 62 cents and a larger amount on one-party and business telephones. There was no increase in cost of four-party line subscribers.

An effort by the Chicago Telephon Company to have suburban and city rates considered together by the public utilities commission was blocked recently by Chester Cleveland, special corporation counsel. He argued that city rates should be considered by themselves and was upheld by the commission. Suburban subscribers protesting against wartime rates were represented by Attorneys Ralph R. Peck and Frederick W. Pringle.

INDIANA

The Farmers Mutual Telephone Company of Columbia City, at an annual meeting recently, elected Dr. O. V. Schuman president, in place of Albert A. Bush, who resigned, with the entire board of directors and other officers, because of a difference of opinion among the stockholders on the proposed consolidation of the Farmers Mutual Company with the Whitley County Telephone Company. A motion was then passed to rescind the action taken by the board of directors in voting to consolidate with any other company. It was also announced that the petition of the two companies for consolidation had been dismissed.

Telephone service is to be extended from the exchange at Logansport to Pottowatomie Point and preparations for making the extension are now being perfected. The connection will be made from the George street line and the work will be carried on as rapidly as possible. There is a very positive forward movement on at Pottowattomie Point and the cottages at this famous summer resort are being modernized in every way. It is believed that many who formerly spent only a few weeks at the place will now spend most of the winter there.

The People's Telephone Company of Colfax has petitioned the public service commission for permission to increase its rates as follows: In cases where patrons own the telephone instrument and drop line, from 50 cents to 75 cents a month. In cases where patrons own only the telephone instruments from 60 cents to 75 cents a month; and in cases where the company supplies both instruments and drops, from $1 to $1.50 a month.

The city of Bloomington and the Bloomington Chamber of Commerce recently petitioned the public service commission for a decrease in telephone rates charged at Bloomington by the Central Union Telephone Company. The petitioners pray for the pre-Burleson rates which are from $1 to 75 cents lower on primary telephones than they were before the higher federal imposed rates went into effect last June.

The Dubois County Telephone Company recently began the work of extensive improvements to its plant for the north end of the city. A large 200-pair cable has been strung from the office at the corner of Main and Fourth Streets forming the main lead to the entire North Side. The new work means practically the rebuilding of nearly all the lines now in that part of the city and when completed the residents of that section will have the best of telephone service. The work, in which the company will invest several thousands of dollars will be pushed to completion during the fall months and before the bad weather sets in.

The Winona Telephone Company recently completed the installation of the new under-ground cable system in the down town part of Winamac, with leads into the south part of town for their toll lines and residence lines in that part of town. The task of installing the new switchboard and connecting with the telephones about town is the next big job ahead.

A petition by the Central Union Telephone Company for authority to increase its rates for Anderson was filed with the Indiana Public Service Commission recently.

IOWA

The Bell Telephone Company has completed the taking over of the plant at Cherokee, the purchase having been made several months ago.

An additional telephone circuit from Eldora to Iowa Falls is being put up by the Iowa Telephone Company. The long distance business has increased to such an extent that new circuits are much needed, particularly north from Eldora. Work has started on a new pole line on the county road to New Providence to provide for a new commercial line half way to Union and to permit the commercial line to New Providence being put in first class condition.

Samuel Kreps was re-elected president and manager of the Lincoln Mutual Telephone Company at a meeting recently following the regular annual meeting of the company. At the annual meeting Charles Hoepner, James E. Wallace and John Jones were re-elected directors, W. R. Goodman was re-elected treasurer and C. F. Roark secretary. Following the annual meeting Mr. Kreps was re-elected as president and general manager. Mr. Kreps has filled this position for a number of years. Under his management the company has grown until it now has 1,700 subscribers, extending from Macksburg to Stuart with lines running northwest of Fontanelle and a line connecting with Dexter. The financial statement of the company as made by Secretary Roark show the total receipts of the company for nine months up until September 30, 1919, to be $15,290.34. The amount paid out for this period including the payment of old notes and obligations was $14,400.33. This leaves a balance on hand of $890.01, with $4,896.48 due the company from all sources not as yet collected.

Employes of the Farmers' Mutual Telephone Company at Clarinda began work recently stringing another wire from the Clarinda office to College Springs and Blanchard. When

completed the installation will be a full metallic line, being a double wire system instead of the former single wire. The new improvement will be a great benefit to patrons in talking. F. M. Lantz, manager of the local company, says that the Clarinda office of Independent lines furnishes more free foreign town and community service than any town in southwest Iowa.

The Prescott Telephone Company has held its annual election of officers, resulting as follows: President, Homer McIlvany; vice president, Harry Putman; secretary, S. E. Fackler; treasurer, F. A. Outhier. The new board of directors are Ernest Rogers, Louis Reese, Clarence West, Albert Grundman and Jule David.

KANSAS

The Belleville Exchange of the Republic County Farmers Telephone Company has sold out to the United Telephone Company and the subscribers of this exchange have been added to the United Telephone Company's switchboard. This will include about 100 subscribers in the territory chiefly from Rydal south to schoolhouse No. 48.

KENTUCKY

The Broadway Telephone Company, Hazel Green, has been incorporated with a capital of $400; incorporators: Alex Shockley, C. S. Cecil and P. L. Center.

MICHIGAN

The Michigan State Telephone Company has made application to the public utilities commission for permission to inaugurate a new increase in telephone rates in Midland and all other towns and cities of the state with the exception of Detroit.

The Michigan State Telephone Company has requested the public utilities commission for a raise in the rates for service on the Wayland exchange. The new rate, if granted as requested, will be boosted to $33 and $30 for business telephones, $24 and $21 for residence service, and $21, $24, $27 or $30 for farm line service, according to whether the service is for business or residence and upon the distance from the central office.

MINNESOTA

Complete readjustment of telephone rates in Minnesota, both local and long distance, will be undertaken by the state railroad and warehouse commission in the near future, Comissioner F. W. Putnam announced recently. The question will be brought up without formal complaints from telephone users or municipalities, on an order directing the companies to show cause why they should not restore their prewar schedules.

Complete telephone connections between Virginia and Mud Lake and between Mud Lake and intermediate points, will soon be an accomplished fact. Telephone poles between Parkville and Mud Lake and West Virginia and Mud Lake are now being put into place and it is expected that the wires will be strung within a short time. Though Parkville proper has had telephone connections for some time, Spring Park and Mud Lake have not. With the completion of the new system the territory included in the district asking for annexation to the city of Virginia will have complete telephone connections.

MISSOURI

It is announced that there will be no change in the telephone rates in Poplar Bluff, or any of the points within the state from which complaint has been made, for a month at least; this time being necessary to enable the Public Service Commission to look thoroughly into the matter.

The public service commission is hearing applications of the Bell Telephone Company for rate increases in virtually all the cities of Missouri except Kansas City. Among those affected are St. Louis, St. Joseph, Springfield, Fulton, Mexico, Clayton, Ferguson, Poplar Bluff, Carrollton, Brookfield, Charleston, Dexter, Hannibal, Kirksville, Chillicothe, Grain Valley.

Floyd Howell has bought of J. M. Freshwater the Hunnewell Telephone Exchange. He took possession recently. Mr. Howell has had several years' experience in the Shelbina Telephone Exchange and understands the business. He will give the Hunnewell patrons good service.

Several of the stockholders in the different mutual telephone companies owning systems in Bates county met recently for the purpose of discussing the matter of installing a mutual switchboard in Butler to handle all the rural telephone business coming to Butler. At this meeting five representatives of the different companies were appointed to take up the matter with their stockholders and make a decision regarding it. This action is the outcome of a long controversy the different rural companies have been having with F. M. Campbell, owner of the Butler-Rich Hill Telephone Company.

NEBRASKA

Results of the formal complaint filed before the State Railway Commission against the Chapman Telephone Association, the Archer Independent Telephone Association and the Nebraska Telephone Company by a number of farmers residing northwest of Central City will be awaited with interest. At present about fifty farmers are unable to have direct telephone service with the city which is their main business point.

The Cortland Telephone Company's old application for increased rates, which the railway commission turned down three months ago, was heard for the second time recently at the commission's office. The advance in rates was denied because it appeared that the service had become very poor and the company was doing nothing at that time to improve it.

NEW YORK

Telephone rates will be increased throughout New York state on December 1, with the exception of New York City, according to an announcement by Division Commercial Manager Spaulding of the New York Telephone Company.

NORTH DAKOTA

The telephone exchange which has been in process of installation at Grenora for some time is now completed, and two central girls will be on the job. It is understood that a large percentage of the residents of the city are installing telephones. A twenty-four hour' service has been promised the patrons.

OHIO

Telephone companies operating in Ohio have been ordered by the public utilities commission of that state to cease collecting the $3.50 service connection charge authorized by Postmaster General Burleson while he was in control of the country's telephones.

Fire did $5,000 damage to the new Ottawa County Telephone Company exchange building at Port Clinton.

The state public utilities commission recently authorized the sale of the Urban Telephone Company to the Champaign Telephone Company for $150,000.

The board of directors of the Perry County Telephone Company met recently at Lancaster and ratified an agreement to purchase the business and plant of the Citizens Independent Telephone Company, upon a valuation agreed upon by officers of the two companies. A petition was also signed at this meeting and forwarded to the state utilities commission, asking that the purchase be approved, that a merger may be made as soon as possible.

The Cleveland Telephone Company has appealed to the public utilities commission to restore the privilege of

charging new subscribers an installation fee of $3.50.

The following directors were elected at the annual telephone meeting at Olena recently: J. N. Bower, D. M. C. Pratt, Floyd Burras, Omer Robbins, John Bellamy.

Work of taking over Bell telephone lines by the Wood County Telephone Company at Bowling Green has been completed. Kellogg switch and toll boards, new telephones and many new lines have been installed.

Following the removal by the government of the war-time installation fee, the Home Telephone Company at Toledo has announced slight reductions in other charges. According to the new schedule transfer charges have been cut from $1.50 to $1. Other special charges have been reduced.

OKLAHOMA

Manager G. W. Steele of the Okemah Telephone Company, announced that the company is planning to rebuild its local system, and expected to start on this work next summer. The company would build a suitable building for the system, and then put in a modern underground system for the town, and said it expected the improvements to cost something like $25,000.

Work has been started on a 48-mile telephone line from Ponca City to Pawhuska.

SOUTH DAKOTA

After years of controversy, the Groton-Ferney Telephone Company and the Dakota Central have reached a working agreement. By the new arrangement the Groton-Ferney Company will take over the Dakota Central local exchange and the Dakota Central will handle all toll business. Under this arrangement a Groton-Ferney subscriber can hereafter get long distance service from his home telephone.

A farmers' telephone company which owns several rural lines will install an exchange in Rutland, to be connected with the rural lines.

TEXAS

About 75 farmers who patronize the rural telephone lines of Washington County met at the court house at Brenham recently to protest against the proposed increase in rates from 25 cents to 50 cents a month for service rendered by the Southwestern Telegraph and Telephone Company. G. G. McNeese, local manager, explained that high cost of labor made the advance necessary and that 50 cents a month was very little to pay for telephone service. A petition protesting against the raise was sent to J. E. Farnsworth of Dallas, vice president of the company. The rural lines are owned by the residents of the communities served, and the charge of 25 cents monthly is for service from the Southwestern Telephone and Telegraph Company.

The appeal in the rate fight between the city of Houston and the Southwestern Telephone Company will be heard by the United States court of appeals in Fort Worth November 10.

Dallas will find her telephone service improved steadily when the new equipment arrives, L. B. Milam, supervisor of public utilities, predicted recently. Mr. Milam said he is confident enough equipment to establish 1,500 new automatic stations for connection with the "Y" exchange, which will relieve the Main exchange of this number, will be received in time to install by February 1.

The Southwestern Telephone Company recently asked the city commission for permission to increase rates in Port Arthur by one-third.

In the matter of the local telephone company asking for the right to increase rates the city engineer in a report made public recently recommends an increase to be effective January 1, provided that in the interim telephone service be bettered.

WISCONSIN

The Portage Telephone Company has started on improvements to its plant in Portage that will approximate $15,000. About half of this amount will be spent for local labor and the remainder for material. Portage has 1,400 telephones now connected with the company's switchboard. One of the big improvements about the city is the extension of the underground cable system.

Patrons of rural telephone lines in western Wisconsin are stirred over the ruling of the railroad commission, effective September 1, that limits free exchange service to the immediate community in which a patron resides. Toll rates are in effect if one desires to talk to a farmer who lives two or three miles away. Under the old system, patrons could talk to friends over a wide expanse of country at a flat monthly rate. Another hearing will be asked of the commission, in an effort to modify the ruling.

The French Ridge Telephone Company was organized at a meeting held at Merrill recently. The new line will run out on the County Home road and east into the French Ridge settlement. The company starts out with about sixteen members. The following are the officers of the new company: President, Elmer Nelson; vice president, Arnold Boettcher; secretary, Norman Nelson; treasurer, Charles Olsen. Directors: M. R. Jole, Steve Severt, Ed. Peterson, Ben Rajek, Herman Neuman.

The railroad commission has refused to grant the Cuba City Telephone Company an increase in rates until that company reorganizes and puts things on a real business basis. The commission estimates that it will take about $10,000 to rebuild the distribution system properly, and that the company must secure revenues to the amount of $5,777.62 annually to give standard service.

The Wisconsin Telephone Company has a crew of men busy resetting the poles and improving the line between Two Rivers and Kewaunee.

The Burlington, Rochester & Kansasville Telephone Company, Burlington, has petitioned the railroad commission for authority to raise the rates on fifteen-party line service from $1 to $1.50 a month, and rates for other service accordingly, asserting that the present rate will not earn a fair return on the property.

Under a decision of the Wisconsin railroad commission, the Bell Telephone Company is permitted to purchase the Bayfield County Telephone Company, the Ashland Home Telephone Company and the North Wisconsin Toll Line Company, operating between Washburn and Ashland and adjacent local territory. For 16 years these Independent companies have been operating in the territory, in opposition to the Bell, but with the present purchase it leaves the Bell people in exclusive control of the telephone business in north Wisconsin. A rate increase also was granted.

The Eastern Wisconsin Telephone Company at Hilbert has made application to the railroad commission for an order to raise its rates.

The Lodi Telephone Company has been incorporated at Lodi with $25,000 stock; W. T. Sparks, Grace A. Sparks and Catherine L. Sparks are the incorporators.

The Marion and Northern Telephone Company have started the construction work on about twelve miles of farm line which will be added to its present system. The new line will leave Clintonville on Seventh Street, and run east in the town of Matteson. There will be added at once about thirty new names to the patrons served out of the local office, and it is expected that by spring the number of patrons on this new line will number between thirty and forty.

CLASSIFIED INDEX

Ammeters.
Leeds & Northrup Co.
Thompson-Levering Co.

Anchors.
Oshkosh Mfg. Co.

Automatic Telephones.
Automatic Electric Co.

Batteries, Dry.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Battery Savers.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.

Boards, Power.
Stromberg-Carlson Tel. Mfg. Co.

Books.
Telephone Engineer.

Booths.
Stromberg-Carlson Tel. Mfg. Co.

Cables.
American Steel & Wire Co.
Electric Cable Co.
Indiana Rbr. & Ins. Wire Co.
National Conduit & Cable Co.
Roebling's Sons Co., John A.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Cable Clamps.
Standard Underground Cable Co.

Cable Hangers.
(See Hangers, Cable.)

Cable Terminals.
(See Terminals, Cable.)

Cleats, Insulated.
Electrose Mfg. Co.

Climbers.
Oshkosh Mfg. Co.

Coils.
Automatic Electric Co.
Leeds & Northrup Co.
Thompson-Levering Co.
Premier Electric Co.

Condensers.
Automatic Electric Co.
Stromberg-Carlson Tel. Mfg. Co.

Conduit.
Shawmut Clay Mfg. Co.

Construction Materials.
Automatic Electric Co.
Oshkosh Mfg. Co.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.
Leich Electric Co.

Cords.
Automatic Electric Co.
Premier Electric Co.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.

Distributing Fixtures.

Electrical Instruments.
Leeds & Northrup Co.
Thompson-Levering Co.

Engineers.

Flat Wire.
American Steel & Wire Co.
Roebling's Sons Co., John A.

Flux, Soldering.
Benson, Alex R.
Blake Signal & Mfg. Co.

Fuses.

Galvanometers.
Leeds & Northrup Co.
Thompson-Levering Co.

Generators.
American Electric Tel. Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Guy Anchors.
Oshkosh Mfg. Co.

Guy Clamps.

Hangers, Cable.
Standard Underground Cable Co.

Harmonic Ringers.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.
Leich Electric Co.

Heat Coils.

Hook Switches.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.

Insulated Staples.
Blake Signal & Mfg. Co.

Insulated Tape.
New York Insulated Wire Co.

Insulation Composition.
Electrose Manufacturing Co.

Intercommunicating Systems.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Joints, Wire.

Keys.
American Electric Tel. Co.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.
Leich Electric Co.

Lightning Arrester.

Linemen's Climbers.
Oshkosh Mfg. Co.

Magnet Wire.
American Steel & Wire Co.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Manhole Covers.
American Brake Shoe & Fdry. Co.

Mouthpieces.
Electrose Mfg. Co.

Nails, Copper.
American Steel & Wire Co.

Patent Experts.

Patent Solicitors.

Pay Stations.
Automatic Electric Co.

Pay-Out Reels.
Oshkosh Mfg. Co.

Platinum.
Baker & Co.

Poles, Cedar.
National Pole Company.

Powder.
Du Pont Powder Co.

Rebuilt Telephones.
Premier Electric Co.

Receivers.
American Electric Tel. Co.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Receiver Cords.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.

Receiver Shells.
Electrose Mfg. Co.

Ringer Sets.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.

Ringing Machines.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Stromberg-Carlson Tel. Mfg. Co.
Leich Electric Co.

Selectors.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.

Staples, Insulated.
Blake Signal & Mfg. Co.

Soldering Paste.
Benson Co., Alex R.
Blake Signal & Mfg. Co.

Soldering Salts.
Benson Co., Alex R.

Supplies.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Leich Electric Co.

Switchboard Cable.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Standard Underground Cable Co.
Stromberg-Carlson Tel. Mfg. Co.

Switchboard Coils.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.

Subway Castings.
American Brake Shoe & Fdry. Co.

Switchboard Cords.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Switchboards, Telephone.
American Electric Co.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Tacks.
American Steel & Wire Co.

Take-Up Reels.
Oshkosh Mfg. Co.

Tape. Insulated.
New York Insulated Wire Co.

Telephones.
Automatic Electric Co.
American Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Premier Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Terminal Blocks.

Terminals, Cable.
Standard Underground Cable Co.

Test Connectors.

Testing Sets.
Leeds & Northrup Co.
Thompson-Levering Co.

Tools.
Oshkosh Mfg. Co.

Transmitters.
American Electric Tel. Co.
Automatic Electric Co.
Kellogg Swbd. & Supply Co.
Leich Electric Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.

Voltmeters.
Leeds & Northrup Co.
Thompson-Levering Co.

Wire, Copper.
American Steel & Wire Co.
Electric Cable Co.
National Conduit & Cable Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.

Wire, Copper Clad.
Standard Underground Cable Co.

Wire, Galvanized Iron.
American Steel & Wire Co.
Indiana Steel & Wire Co.
Roebling's Sons Co., John A.

Wire Rods.
American Steel & Wire Co.
Standard Underground Cable Co.

Wire Rope Fittings.
American Steel & Wire Co.
Roebling's Sons Co., John A.

Wire, Rubber Covered.
American Steel & Wire Co.
New York Insulated Wire Co.
Roebling's Sons Co., John A.
Simplex Wire & Cable Co.
Standard Underground Cable Co.

Wire. Strand.
American Steel & Wire Co.
Indiana Steel & Wire Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.

Wire, Weatherproof.
American Steel & Wire Co.
Electric Cable Co.
Indiana Rbr. & Ins. Wire Co.
National Conduit & Cable Co.
New York Insulated Wire Co.
Roebling's Sons Co., John A.
Simplex Wire & Cable Co.
Standard Underground Cable Co.

Wires and Cables, Electric.
Kellogg Swbd. & Supply Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.
Stromberg-Carlson Tel. Mfg. Co.
Western Electric Co.